Eugene School District 4J

Camas Ridge Community Elementary School

1150 East 29th Avenue, Eugene, Oregon 97403

Project Manual

100% Construction Documents

February 18, 2022

CIP#: 460.282.001

Architect's Project Number: 2021.00

SECTION 00 0101

PROJECT TITLE PAGE

PROJECT INFORMATION

PROJECT NAME

Camas Ridge Community Elementary School

DATE OF ISSUE

February 18, 2022

PROJECT OWNER

Eugene School District 4j

CIP NUMBER

460.282.001

ARCHITECT'S PROJECT NUMBER

2021.00

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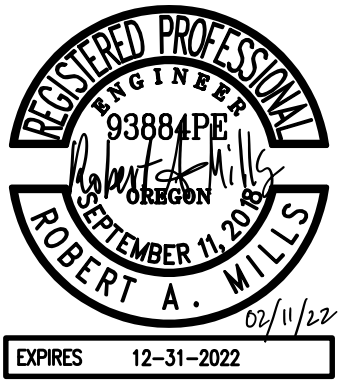

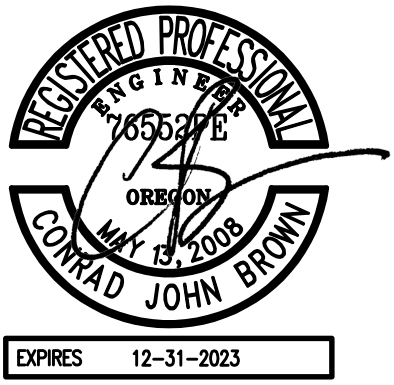

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FS304 FOOD SERVICE ELEVATION AND FABRICATION DETAILS
FS305 FOOD SERVICE ELEVATION AND FABRICATION DETAILS
FS306 FOOD SERVICE ELEVATION AND FABRICATION DETAILS

END OF SECTION

SECTION 00 0116

INVITATION TO BID

CM/GC: REPLACE THIS PAGE WITH YOUR REQUIREMENTS

END OF SECTION 00 0116

SECTION 00 2113

INSTRUCTIONS TO BIDDERS

CM/GC: REPLACE THIS PAGE WITH YOUR REQUIREMENTS

END OF SECTION 00 2113

SECTION 00 3100

AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:

B. Site Survey: Entitled Camas Ridge School Survey, dated 01/20/2021.

C. Geotechnical Report: Entitled Report of Geotechnical Engineering Services, dated March 01, 2021.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 00 3100

SECTION 00 4100

BID FORM

CM/GC: REPLACE THIS PAGE WITH YOUR REQUIREMENTS

END OF SECTION 00 4100

SECTION 00 5213

SUBCONTRACTOR AGREEMENT - SAMPLE

CM/GC: REPLACE THIS PAGE WITH YOUR REQUIREMENTS

END OF SECTION 00 5213

SECTION 00 5263

PURCHASE ORDER - SAMPLE

CM/GC: REPLACE THIS PAGE WITH YOUR REQUIREMENTS

END OF SECTION 00 5263

SECTION 00 5432

TRADE DAMAGE CLAUSE - SAMPLE

CM/GC: REPLACE THIS PAGE WITH YOUR REQUIREMENTS

END OF SECTION 00 5432

SECTION 00 5442

TEXTURA PAYMENT OVERVIEW

CM/GC: REPLACE THIS PAGE WITH YOUR REQUIREMENTS

END OF SECTION 00 5442

SECTION 00 6113

PERFORMANCE & PAYMENT BONDS

PART 1 GENERAL

1.01 FORM OF THE BONDS

A. The Performance & Payment Bonds called for in the General Conditions shall be executed on the AIA DOCUMENT A-312. A copy of this Form is bound in the Appendix Section of this Project Manual.

END OF SECTION 00 6113

SECTION 00 6115

PUBLIC WORKS BOND

PART 1 GENERAL

1.01 PUBLIC WORKS BOND

A. The Contractor and each subcontractor shall have a public works bond in the amount of $30,000 before starting work, unless exempt under ORS 279C.836(4), (7), (8), or (9). The contractor is required to include in every subcontract a provision requiring the subcontractor to have a public works bond filed with the Construction Contractors Board before starting work on the project, unless an exempt under ORS 279C.836(4),(7),(8) or (9). Before permitting a subcontractor to start work on a public works project, the contractor shall verify that the subcontractor has filed a public works bond or has elected not to file such bond under ORS 279.836 (7) or (8) or is exempt under ORS 279C.836(4) or (9). The Contractor shall provide a certification to Owner that Contractor and all subcontractors have filed the public works bond, unless exempt under ORS 279C.836(4), (7), (8), or (9).

1. [Effective Jan 1, 2008 - Applies to business enterprises certified before, on or after January 1, 2008 and to contracts for projects first advertised, or if not advertised then entered into, on or after January 1, 2008]

B. This bond is in addition to any performance bond and payment bond requirements. The bond must meet all Bureau of Labor and Industries requirements and provide that the contractor and subcontractor will pay claims ordered by the Bureau of Labor and Industries to workers performing labor on public works projects.

END OF SECTION 00 6115

SECTION 00 7200

GENERAL CONDITIONS

GENERAL CONDITIONS

1.01 RELATED REQUIREMENTS

A. Section 00 5213 - Subcontract Agreement: The proposed sub-contract to be executed between the sub-contractor and the Construction Manager / General Contractor.

1.02 FORM OF GENERAL CONDITIONS

A. AIA document A201, General Conditions of the Contract For Construction, 2017 Edition, shall be the general conditions between the Owner and Construction Manager / General Contractor. The document is attached in Appendix A of this Project Manual.

B. The Contractor and all Sub-contractors and Suppliers shall read and be governed by them.

END OF SECTION 00 7200

SECTION 00 7343

PREVAILING WAGE RATES

PART 1 GENERAL

1.01 PREVAILING WAGE RATES

A. The prevailing wage rates dated January 1, 2022, including any subsequent corrections or amendments issued by the Oregon Bureau of Labor and Industries, are included as a portion of the contract documents by reference. Copies are available for review at the office of Facilities Management, School District 4j, and can be viewed online at https://www.oregon.gov/boli/whd/pwr/pages/index.aspx. Click on prevailing wage rates, then PWR rates – 2022.

END OF SECTION 00 7343

SECTION 01 1000

ASBESTOS CONTAINING MATERIALS NOTIFICATION

CM/GC: REPLACE THIS PAGE WITH OWNER'S NOTIFICATION

END OF SECTION 01 1000

SECTION 01 1000

ASBESTOS CONTAINING MATERIALS STATEMENT

CM/GC: REPLACE THIS PAGE WITH OWNER'S STATEMENT

END OF SECTION 01 1000

SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Camas Ridge Community Elementary Replacement School

B. Owner's Name: Eugene School District 4j

C. Owner's Project Manager: Glen Macdonald

D. Architect's Name: PIVOT Architecture

E. The project consists of the construction of a new two-story elementary school, with a third level mechanical platform, demolition of the existing school, and related new site work.

1.02 CONTRACT DESCRIPTION

A. Contract Type: Construction Manager/General Contractor (CM/GC) contract based on guaranteed maximum cost as described in Document 00 52 00 - Agreement Form.

1.03 WORK BY OWNER

A. Work Under Separate Contract: The Owner will award separate contracts for the following:
   1. Asbestos Abatement: Scheduled to be completed between 7/18/202 and 8/7/2022.
      a. Contractor: Professional Minority Group.
   2. Technology: Wiring, hardware and programming for classroom speakers, intercom, teacher control stations, ceiling vault and access panels for classrooms.
      a. Contractor: To be determined.
   3. Commissioning, Testing and Balancing:
      a. Contractor: To be determined..

B. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
   1. Furnishings.
   2. Small equipment.
   3. Artwork, except for glass art tiles as noted below.

C. Owner will furnish the following items for installation by Contractor (OFCI):
   1. Section 05 70 00 - Decorative Metal:
      a. Artwork images in digital form for custom metal panels.
   2. Section 06 20 00 - Finish Carpentry:
      a. Artwork images in digital form for custom plastic laminate.
   3. Section 10 28 00 - Toilet, Bath, and Laundry Accessories:
      a. Toilet Paper Dispensers.
      b. Paper Towel Dispensers.
      c. Soap Dispensers.
      d. Toilet Seat Cover Dispensers.
      e. Sanitary Napkin Dispensers.
      f. Sanitary Napkin Disposals.
      g. Electric Hand Dryers.
   4. Division 28 - Electronic Safety and Security
      a. Video surveillance cameras and mounts.
   5. General requirements concerning Owner furnished items:
      a. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
      b. Owner will arrange and pay for delivery of Owner-furnished items according to a mutually coordinated Construction Schedule.
      c. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.

d. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
e. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
f. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
g. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
h. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.

1.04 CONTRACTOR USE OF SITE

A. Construction Operations: Limited to the project site.

B. Arrange use of site and premises to allow:
1. Work by Others.
2. Work by Owner.

1.05 WORK SEQUENCE AND SCHEDULE

A. Construct Work in phases during the construction period:
1. Phase 1: Existing Building Demolition; commence work following completion of Owner's asbestos abatement.
2. Phase 2: New Facilities; commence work following demolition of existing building; schedule to achieve Substantial Completion **by date to be determined**.
3. Final Completion: Schedule work to achieve Final Completion of all Work within 45 days of the date of Substantial Completion.

B. Coordinate construction schedule and operations with Owner.

C. Liquidated Damages: Refer to General Conditions for contract requirements.

1.06 MISCELLANEOUS PROVISIONS

A. Drug and Alcohol Policy:
1. The possession, use, or distribution of illicit drugs and alcohol on school premises is prohibited. Prescription medications brought to the project site shall be in the original container bearing the name of the drug, the name of the physician and the prescribed dosage.

B. Use of Tobacco Products:
1. Smoking and the other use of tobacco products is prohibited on all school district property pursuant to OAR 581-021-0110.

C. Safety Requirements:
1. Safety must not be sacrificed for the sake of productivity or expedience. Safety of students, staff, and the public is critical. Take all reasonable precautions to prevent endangerment or injury. Advise and coordinate operations with the school office.
2. All contractors who perform work on District property, and their employees, are expected to know the District's expectations for safe work and to adhere to those expectations.
3. Contractors are to adhere to the regulations of Oregon OSHA for all projects within the School District.

D. General Safe Work Practices:
1. Students, public and school staff shall not be put at risk by the activities of contractors or their employees.
2. Safe vehicle operation rules are to be followed at all times. These include positioning vehicles to minimize the necessity of backing and providing a "spotter", someone who will make sure that people do not run into the path of a vehicle when driving on a playground or field that is occupied by students.
3. Tools shall never be left out when an unsecured work area is vacated.
4. Ladders and scaffolding will be taken down when an unsecured work area is vacated.

5. Open holes and other tripping hazards shall be fenced or barricaded when an unsecured work area is vacated.
6. Operations resulting in vapors, emissions or flying objects shall be conducted in such a way as to prevent exposure to any unprotected parties or property.
7. "Secured Work Area" is defined as an area having a perimeter cyclone fence at least 6 feet in height, with gates which close and lock so that no casual entrance is possible by unauthorized adults or children.
8. Contractor to follow all OR-OSHA rules for Confined Spaces, where applicable.

E. Communications Regarding Unsafe Practices:
1. Upon perceiving a problem, the District will immediately communicate the concern to the Contractor or Contractor's representative on the work site.
2. If agreement on correction of unsafe conditions cannot be reached, the concerns of the District shall prevail and safety concerns shall be addressed in accordance with the District requirements.

F. Electrical Panels - Lockout/Tagout:
1. Contractor shall implement a Lockout/Tag-out program for his employees who take equipment out of service or place equipment back into service. Contractor shall review the District's Energy Control Program prior to commencing work. Rules applying to this procedure are Oregon Occupational Safety and Health Code OAR 437, Division 2, Subdivision J, General Environmental Controls Lockout/Tag-out (1919.147), or latest edition.

G. Arc Flash - Electrical Safety:
1. Comply with NFPA 70E (Electrical Safety in the Workplace), current edition. Contractor shall comply with Oregon OSHA 1910.137 (Personal Protective Equipment). Review with the School District Project Manager the 'Eugene School District Electrical Safety Program' before any work commences. Comply with all 'Arc Flash' and 'Electrical Safety' protocols referenced in any and all NFPA, OSHA, OROSHA, NEC, NESC, UL, IBC, IFC and ANSI documents (current editions).

H. Potentially Hazardous Products (Existing Building):
1. The District attempts to maintain a safe and healthy environment for students and staff. The Contractor is therefore required to follow District guidelines controlling the use of potentially hazardous products and to use these products in a safe manner. Guidelines include the use of materials (adhesives, coatings, carpeting, etc.) which are known to emit little or no airborne pollutants.
2. MSDS information is required for all potentially hazardous products. The Project Manager and a District Safety Specialist will review these and determine what, if any, mitigation procedures will be required.
3. Contractor is to maintain and post copies of all MSDS information at the project site and adhere to the required controls.
4. Contractor is to ensure that work area by students and teachers is restricted. The District will provide signage appropriate for this purpose. The Contractor is to construct and maintain appropriate barriers. This shall include provision of physical separation barriers between "construction" and "occupied" spaces.
5. Contractor to adopt means of maintaining the construction space in negative air pressure in relation to occupied spaces.
6. Where there is a new or existing ventilation system in an affected space, the system shall be adjusted to provide the maximum amount of outside air possible with the system.
7. Efforts shall be made to install and operate new ventilation systems as soon in the construction process as practical.

I. Asbestos Containing Materials Warning:
1. Asbestos containing materials are known to exist in areas of the Work. The Contractor shall not, in any way, disturb materials which are known to contain asbestos, assumed to contain asbestos, or otherwise have not been tested and confirmed to be asbestos free.

2. Where access to concealed spaces is required, or it is necessary to disturb building materials such as for drilling of holes, cutting, etc., notify the Owner so that proper investigation and/or removal procedures are followed.
3. Prior to commencing Work, the Contractor shall meet with the District Safety Specialist and review the Owner's Asbestos Management Plan for the locations of asbestos-containing materials and/or materials assumed to contain asbestos. After reviewing the Owner's
4. Asbestos Management Plan, the Contractor is required to sign Form 01 10 00A, Asbestos-containing Materials Notification Statement, provided at the end of this Section.
5. Contractor must not install any asbestos-containing materials when performing the Work of this project. At the completion of the Work, Contractor will be required to furnish a statement stating that no asbestos-containing materials were installed during the course of the Work. Refer to Sample Form 01 10 00 B at the end of this Section.

J. Full Time Superintendent Disclosure Statement
1. Prior to or in conjunction with the Preconstruction Conference, the Contractor shall submit the disclosure statement which identifies the Full Time Superintendent for this Project. The form for this statement, Form 01 10 00C, is provided at the end of this Section.

1.07 COORDINATION AND PERMITS

A. Coordination
1. The Contractor is responsible for overall coordination of the Project.
2. The Drawings and Specifications are arranged for convenience only and do not necessarily determine which trades perform the various portions of the Work.
3. Coordinate sequence of work to accommodate agreed-upon Owner occupancy.
4. Perform all necessary work to receive and/or join the work of all trades.
5. Verify location of existing utilities and protect from damage.

B. Permits and Fees
1. The Owner will be responsible for filing and paying for building permits and all fees associated with the building permit, system development charges, impact fees, etc. The Contractor will be responsible for picking up all Project permits and will have full responsibility for requirements of and payments for all trade permits (i.e. electrical, plumbing, mechanical).

1.08 DELEGATED DESIGN REQUIREMENTS

A. Certain components of the Work under this project are Delegated Design. It is the Contractor's responsibility to coordinate and assume or assign to subcontractors the complete responsibilities for the design, calculation, submittals, fabrication, transportation and installation of the Delegated Design portions or components as required. Delegated Design components of the Work are defined as complete operational systems, provided for their intended use.

B. Submit deferred submittals for delegated design elements to the governing agency for the separate approval of each Delegated Design item as defined in Section 01 3300 - Submittal Procedures.

C. Owner shall not be responsible to pay for any delays, additional products, additional hours of work or overtime, restocking or rework required due to failure by the Contractor or the subcontractor to coordinate their work with the work of the other trades on the project or to provide the Delegated Design portion or component in a timely manner to meet the schedule of the project.

D. Delegated Design components include, but are not limited to the following:
1. Steel Joists, Section 05 2100 - Steel Joist Framing.
2. Ship's Ladders, Section 05 5000 - Metal Fabrications.
3. Metal Stairs, Section 05 5100 - Metal Stairs.
4. Metal Roof Panels, Section 07 4113 - Metal Roof Panels.
5. Metal Wall Panel Support Framing, Section 07 4213 - Metal Wall Panels.
6. Fall Arrest Roof Anchorage, Section 07 7 273 - Fall Arrest Roof Anchors.

7. Firestopping, Section 07 84 00 - Firestopping.
8. Aluminum Storefront, Section 08 4313 - Aluminum-Framed Storefronts.
9. Seismic Anchorage for Suspended Acoustical Ceilings, Section 09 5100 - Acoustical Ceilings.
10. Flagpoles, Section 10 7500 - Flagpoles.
11. Seismic Anchorage Foodservice Equipment, Section 11 4000 - Foodservice Equipment.
12. Canopy Hood/Fire Protection, Section 11 4000 - Foodservice Equipment.
13. Walk-in Cold Storage Rooms, Section 11 4000 - Foodservice Equipment.
14. Elevators, Section 14 2400 - Hydraulic Elevators.
15. Seismic Anchorage Divisions 21, 23, 26, 27 and 28 equipment, hoods, panels and other components of mechanical, plumbing, gas and electrical systems.
16. Fire Suppression, Division 21.
17. Fire Alarm System, Division 28.
18. Chain Link Backstop, Section 32 3113 - Chain Link Fences and Gates
19. Decorative Metal Cantilevered Sliding Vehicle Gate, Section 32 3119 - Decorative Metal Fencing
20. Site Retaining Wall System, Section 32 3223 - Concrete Segmental Retaining Wall System
21. Additional requirements from specific sections.

1.09 PUBLIC RIGHT OF WAY WORK

A. Improvements in the Public Right of Way along 29th Avenue are to be performed under a Lane County Facility Permit. Drawings prepared under standards for Privately Engineered Public Improvements (PEPI) are included in the Work of this Contract. Follow referenced standards for Public Right of Way work including but not limited to inspections, procedures, testing, standard specifications, standard details, and requirements. The requirements of the County Facility Permit notwithstanding, the Contractor shall be bound by the General and Supplementary General Conditions and to the Agreement between Owner and Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 1000

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 01 20 01 - Change Order/Proceed Order Form.

B. Section 01 32 16 - Construction Progress Schedule.

C. Document 00 72 00 - General Conditions: Additional requirements for progress payments, final payment, changes in the Work.

D. Document 00 73 00 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Coordinate with Section 01 3216 - Construction Progress Schedule.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic media printout will be considered.

F. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

G. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.

H. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
   1. Provide several line items for principal subcontract amounts, where appropriate.
   2. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
   3. 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.
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

I. Include within each line item, a direct proportional amount of Contractor's overhead and profit.

J. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. 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 (draft submitted previously).
   3. Contractor's Construction Schedule (preliminary if not final).
   4. Products list.
   5. Schedule of unit prices.

6. Submittals Schedule (based Architect's list or required submittals).
7. List of Contractor's staff assignments.
8. Initial progress report.
9. Report of preconstruction conference.

B. Payment Period: Submit at intervals stipulated in the Agreement.

C. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

D. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

E. Forms filled out by hand will not be accepted.

F. Present required information in typewritten form.

G. Form: AIA G702 Application and Certificate for Payment and AIA G703 - Continuation Sheet including continuation sheets when required.

H. For each item, provide a column for listing each of the following:
1. Item Number.
2. Description of work.
3. Scheduled Values.
4. Previous Applications.
5. Work in Place and Stored Materials under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

I. Notarize and execute certification by signature of authorized officer.

J. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
1. Entries must match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.

K. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

L. Submit one electronic copy of each Application for Payment.

M. Include the following with the application:
1. Transmittal letter as specified for submittals in Section 01 30 00.
2. Construction progress schedule revised and current as specified in Section 01 30 00.
3. Partial release of liens from major subcontractors and vendors.

N. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. Minor Changes in the Work: For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor with concurrence of the Owner.

B. Change Request/Proceed Order: Architect or Owner may issue a Change Request/Proceed Order on Form 01 20 01 - Change Request/Proceed Order.
1. Change Request contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
2. Proceed Order, when signed by the Owner, instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

3. When a Change Request is approved and signed by the Owner, it becomes a Proceed Order authorizing the change requested. Do not proceed with any change without the Owner's signature on the Change Request/Proceed Order.

C. Owner-Initiated Change Requests: Architect will issue a Change Request, which will include a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Change Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Change Request after receipt of Change Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change

D. Contractor-Initiated Requests: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to the Architect.
   1. Changes requested by the Contractor will be authorized only by signature of the Owner on the prescribed. Do not proceed with any changes without this authorization.
   2. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   3. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   4. Comply with requirements in Section 01 60 00 - Product Requirements, if the proposed change requires substitution of one product or system for product or system specified.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
   4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

F. Documentation/Substantiation of Costs: Provide full information required for evaluation.
   1. On request, provide the following data:
      a. Quantities of products and equipment.
      b. Costs of labor, supervision, overhead, and profit directly attributable to the change.
      c. Taxes, insurance, and bonds.
      d. Overhead and profit.
      e. Justification for any change in Contract Time.
      f. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
   3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

1.06 APPLICATION FOR PAYMENT AT SUBSTANTIAL COMPLETION

A. 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.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1.07 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 70 00.
   2. Updated final statement, accounting for final changes to the Contract Sum.
   3. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   4. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
   5. AIA Document G707, "Consent of Surety to Final Payment."
   6. Evidence that claims have been settled.
   7. Final, liquidated damages settlement statement.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2000

SECTION 01 2200

UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. List of unit prices, for use in preparing Bids.

B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 RELATED REQUIREMENTS

A. Document 00 2113 - Instructions to Bidders: Instructions for preparation of pricing for Unit Prices.

B. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.04 UNIT QUANTITIES SPECIFIED

A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.05 MEASUREMENT OF QUANTITIES

A. Assist by providing necessary equipment, workers, and survey personnel as required.

B. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
   1. Measurement of excavated material shall be in situ, prior to excavation.
   2. Measurement of imported fill material shall be in situ, after compaction.
   3. The transported volume of material to or from the site will not be used as measurement.

C. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.

1.06 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. Payment will not be made for any of the following:
   1. Products wasted or disposed of in a manner that is not acceptable.
   2. Products determined as unacceptable before or after placement.
   3. Products not completely unloaded from the transporting vehicle.
   4. Products placed beyond the lines and levels of the required Work.
   5. Loading, hauling, and disposing of rejected Products.

1.07 DEFECT ASSESSMENT

A. Replace Work, or portions of the Work, not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct one of the following remedies:
   1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Architect.
   2. The defective Work will be partially repaired to the instructions of the Architect, and the unit price will be adjusted to a new unit price at the discretion of Architect.

C. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2200

SECTION 01 2300

ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

1.02 RELATED REQUIREMENTS

A. Document 00 2113 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

1.03 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Alternative Roof Framing:

1. Under the Base Bid: Provide roof framing described on Drawings.
2. Under Alternate #1: Provide roof framing described on Alternate Roof Framing Drawings--S141-ALT, S142-ALT, and S143-ALT, among others--and associated modifications to the Work required to accommodate the framing system described therein.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2300

CHANGE REQUEST / PROCEED ORDER

Capital Improvement Program - Eugene School District 4J

CHANGE REQUEST NOTICE No._____ Date: _____

Project No.:_____ Contract No.:_____ Date: _____

Project Title: _____

Contractor: _____

1. REQUEST INFORMATION

Estimated $_____ Time_____Days_____Initiated by _____

Reason for change:

_____

2. DESCRIPTION

Describe changes: _____

_____

Describe affected work: _____

List plan and spec sections: _____

Describe impacted activities: _____

Comment: _____

3. DATES

Need for change first known _____ By whom _____

Contractor first notified _____ How _____

Owner first notified _____

Date approved or rejected_____By whom _____

4. RECOMMENDATION (cost and time) _____

……

PROCEED ORDER No.: _____ Date: _____

1. PAYMENT/COST

Actual amount of change $_____ The contract time will be:

Contractor amount $_____( ) increased ( ) decreased by_____days

Subcontractor amount $_____( ) will remain unchanged

Type of payment (LS/T&M) _____

2. MISCELLANEOUS

Subcontractors involved: _____

Major materials:_____

The cost is not to exceed $_____ Date: _____

3 **CHANGE REQUEST ACCEPTED BY:**

Contractor:_____ Date:_____

Architect:_____ Date:_____

4J CIP Project Manager: _____ Date:_____

4J CIP Program Manager: _____ Date:_____

4J Facilities Director: _____ Date: _____

Without the signature of Facilities Director, or the acting Director, this Proceed Order is neither accepted or authorized, except by written authorization of other specific delegation.

END OF FORM

SECTION 01 3000

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Progress meetings.

E. Submittals for review, information, and project closeout.

F. Number of copies of submittals.

G. Requests for Information (RFI) procedures.

H. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions: Dates for applications for payment.

B. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.

C. Section 01 6000 - Product Requirements: General product requirements.

D. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

E. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Conform to requirements of Section 01 7000 - Execution and Closeout Requirements for coordination and execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Information (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

1.04 CONSTRUCTION ORGANIZATION & START-UP

A. Responsible Parties:
   1. Immediately following Contract execution, Owner and Contractor shall each identify who, within their respective organizations, will be responsible for Project Coordination.

B. The Contractor shall establish on-site Lines of Authority and Communications including the following:
   1. Schedule attendance at Preconstruction Meeting and schedule and conduct Progress Meetings as specified in herein.
   2. Establish procedures for Intra-project Communications including:
      a. Submittals.
      b. Reports & Records.
      c. Recommendations.

d. Coordination Drawings.
e. Schedules.
f. Resolution of Conflicts.

3. Technical Documents Interpretation:
   a. Consult with Architect to obtain interpretation.
   b. Assist in resolution of questions or conflicts which may arise.
   c. Transmit written interpretations to Subcontractors and to other concerned parties.
4. Permits & Approvals:
   a. Verify that Subcontractors have obtained required Permits and Inspections for Work and for Temporary Facilities.
5. Control use of Site:
   a. Supervise Field Engineering and Project Layout.
   b. Allocate Field Office Space and Work and Storage Areas for use of each Subcontractor.

1.05 COORDINATING SUBCONTRACTORS' WORK

A. Coordinate the Work of all Subcontractors and make certain that, where the Work of one Trade is dependent upon the Work of another Trade, the Work first installed is properly placed, installed, aligned, and finished as specified or required to properly receive subsequent Materials applied or attached thereto.

B. Direct Subcontractors to correct defects in Substrates they install when Subcontractors of subsequent Materials have a reasonable and justifiable objection to such surfaces.

C. Do not force Subcontractors to apply or install Products to improperly placed or improperly finished Substrates that would result in an unsatisfactory or unacceptable finished Product.

1.06 COORDINATING WORK WITH WORK OF OWNER OR OTHER CONTRACTS

A. Coordinate, and make certain that, where Work of either party is dependent upon the other party, the Work first performed is properly placed, installed, aligned, and finished as required to permit the proper installation of the Work following.

B. If the Owner's Work in any way interferes with the Contractor's Work, so notify the Owner sufficiently in advance so that the Owner has reasonable time to make necessary adjustments.

C. If the Contractor's Work in any way interferes with Owner's Work, so notify the Owner as soon as possible. If the Contractor's Work must be modified to accommodate the Owner's Work, except as described elsewhere in this Specification, the Contract Sum and/or the Contract Time will, when necessary be adjusted by a Change Order.

1.07 CLOSE-OUT DUTIES

A. Mechanical & Electrical Equipment start-up:
   1. Coordinate check-out of Utilities, Operational Systems, and Equipment.
   2. Assist in initial start-up and testing.
   3. Record starting dates of Systems and Equipment operation.

B. At completion of Work of each Subcontract, conduct inspection to assure that:
   1. Work is acceptable.
   2. Specified cleaning has been accomplished, and Temporary Facilities and Debris has been removed from Site.

C. Substantial Completion:
   1. Conduct inspection and prepare list of Work to be completed or corrected.
   2. Assist Architect in review of contractor’s inspection list and generation of substantial completion punch list.
   3. Supervise correction and completion of Work as established in Architect's Observation Reports and substantial completion punch list.
   4. Apply for and receive Final Occupancy Permit from Building Department.
   5. Complete submittal of Operations and Maintenance Manuals.
   6. Complete submittal of Record Drawings.

7. Complete Owner Training.

D. Final Completion:
   1. Assist Architect in checking that all identified deficiencies have been corrected.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, MS Excel, or AutoCAD .dwg or Revit .rvt) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:
   1. Newforma Project Center, hosted by Architect.

C. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
   4. Contractor's Superintendent.
   5. Major Subcontractors .

C. Agenda:
   1. Introductions.
   2. Execution of Owner-Contractor Agreement.
   3. Submission of executed bonds and insurance certificates.
   4. Description of Project
   5. Distribution of Contract Documents.

6. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
7. Designation of personnel representing the parties to Contract and Architect.
8. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
    a. ( ) Written Change Order requests required
    b. ( ) Supporting documentation will be required for all Change Order proposals
    c. ( ) Describe Contractor's procedure for review and oversight in the preparation of Change Orders
    d. ( ) Mark-up limitations on Change Orders (See General Conditions Article 7.1.4)
    e. ( ) Processing time required
    f. ( ) Applications for Payment
        1) ( ) Use AIA documents G702 and G703 latest edition
        2) ( ) Wage certifications to be attached or submitted directly to Owner
9. Scheduling, start date and date of substantial completion.
10. Building permit status.
11. Prevailing wage requirements.
12. Public Agency submittal of Responsible Bidder Determination Form to Construction Contractor's Board (ORS 279C.375).
13. Communications.
14. Role of Owner's Project Manager.
15. Employee Security Screening and Identification Badging.
16. Submittals required per Contract Documents.
17. MSDS Information
18. Erosion control procedures
19. Waste management procedures
20. Environmental quality requirements
21. Hazardous materials
22. Construction activities, working hours, use of site and building.
23. Staging and parking areas.
24. Temporary facilities and utilities.
25. Request for information and clarification of design
26. Correction of Defects.
27. Weekly on-site progress meetings.
28. Safety and Emergency Procedures.
29. Verify that Contractor's Mandatory Drug Testing Program is in place.
30. Daily Clean-up
31. Project Closeout, substantial completion, final completion.
32. Record Drawings and Operations and Maintenance Manuals
33. Tour of Project by Owner's staff and guests (if applicable)
34. Additional Comments

D. Architect will record minutes and distribute copies within [five] days after meeting to participants, with digital copies to Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.

5. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to the work.

E. Record minutes and distribute copies within five days after meeting to participants, with digital copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PRE-INSTALLATION CONFERENCES

A. When required in individual specification sections, the Contractor shall convene a pre-installation meeting prior to commencing work of that section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect minimum four days in advance of meeting date.

D. The Contractor shall be responsible to prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.
   2. Review coordination with related work.

E. The Contractor shall be responsible to record minutes and distribute copies within four days after meeting to participants, with copies to Architect, Owner's Project Manager, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

C. Within 10 days after joint review, submit complete schedule.

D. Submit updated schedule with each Application for Payment.

3.06 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.
    a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    b. Do not forward requests which solely require internal coordination between subcontractors.
2. Prepare in a format and with content acceptable to Owner.
3. Prepare using software provided by the Electronic Document Submittal Service.
4. Combine RFI and its attachments into a single PDF Format electronic file.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
    a. Approval of submittals (use procedures specified elsewhere in this section).
    b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
    c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
    d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Discrete and consecutive RFI number, and descriptive subject/title.
3. Issue date, and requested reply date.
4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.
5. Identify and include improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
   3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
   4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.07 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
   2. Coordinate with Contractor's construction schedule and schedule of values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.08 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
   5. Other information required in individual specification sections.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Product Data:
   1. Clearly mark each copy to identify pertinent Products.
   2. Show performance characteristics and capacities.
   3. Show dimensions, field dimensions, and required clearances.
   4. Show wiring and piping diagrams, and controls.
   5. Show standard schematic drawings and diagrams:
      a. Modify to delete information not applicable to Work.
      b. Supplement standard information to provide information specifically applicable to Work.
      c. Assure that any photo copied material is clearly legible or provide all original material.

D. Samples will be reviewed for aesthetic, color, or finish selection.

E. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.09 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other information required in individual specification sections.
   8. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other information required in individual specification sections.
   6. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; two of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.
   3. Show full range of color, texture & pattern.

3.12 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item.
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   3. Transmit using approved form.
      a. Use Contractor's form, subject to prior approval by Architect.
   4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.

7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   a. Send submittals in electronic format via email to Architect.
   b. Unless otherwise approved by the Architect in advance of receipt of the submittal, all information and any markup of PDF documents shall be produced using appropriate PDF editing software, and not handwritten. PDF documents shall not be scanned original copies, but shall be submitted in their original digital form and remain fully searchable using PDF viewing software in common use.
8. Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
   b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
9. Notify Architect in writing, at submission time, of any deviations in Submittals from Contract Document requirements. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
10. Provide space for Contractor and Architect review stamps.
11. When revised for resubmission, identify all changes made since previous submission.
12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
14. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Submit concurrently with related shop drawing submittal.
   4. Do not submit (Material) Safety Data Sheets for materials or products. Maintain a copy of the MSDS sheets on site.

C. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.
   3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
   1. Transmit related items together as single package.
   2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

E. Perform no Work or Fabrication requiring Submittal until Architect approves Submittal.

3.13 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
   1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
    1. Authorizing purchasing, fabrication, delivery, and installation:
        a. "No Exceptions Taken", or language with same legal meaning.
        b. "Make Corrections Noted", or language with same legal meaning.
            1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
        c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
            1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
            2) Non-responsive resubmittals may be rejected.
    2. Not Authorizing fabrication, delivery, and installation:
        a. "Revise and Resubmit".
            1) Resubmit revised item, with review notations acknowledged and incorporated.
            2) Non-responsive resubmittals may be rejected.
        b. "Rejected".
            1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
    1. Items for which no action was taken:
        a. "Received" - to notify the Contractor that the submittal has been received for record only.
    2. Items for which action was taken:
        a. "Reviewed" - no further action is required from Contractor.

END OF SECTION 01 3000

SECTION 01 3216

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

C. Construction progress schedule, three week look ahead.

1.02 RELATED SECTIONS

A. Section 01 1000 - Summary: Work sequence.

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit schedules as a PDF file to the Architect and Owner.

1.04 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Sheet Size: 11 x 17 inches or 22 x 34 inches.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Include conferences and meetings in schedule.

F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

H. Indicate delivery dates for owner-furnished products.

I. Coordinate content with schedule of values specified in Section 01 2000 - Price and Payment Procedures.

J. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 THREE WEEK LOOK AHEAD SCHEDULE

A. Each week during construction, provide companion schedule to master project schedule to look ahead three weeks. Provide increased detail as requested by the Owner or Architect to clearly show the work planned for the upcoming weeks.

B. Distribute at the beginning of each weekly project meeting.

C. Update as necessary.

3.05 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.06 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.07 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 3216

SECTION 01 3553
SECURITY PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Security measures including formal security program, entry control, personnel identification, and miscellaneous restrictions.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: use of premises and occupancy.

B. Section 01 5000 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.

B. Initiate program at project mobilization.

C. Maintain program throughout construction period until Owner occupancy.

1.04 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities.

B. Allow entrance only to authorized persons with proper identification.

C. Maintain log of workers and visitors, make available to Owner on request.

1.05 RESTRICTIONS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 3553

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. References and standards.

C. Testing and inspection agencies and services.

D. Contractor's design-related professional design services.

E. Control of installation.

F. Mock-ups.

G. Tolerances.

H. Manufacturers' field services.

I. Defect Assessment.

J. Testing and inspection agencies and services.

K. Repair and protection.

1.02 RELATED REQUIREMENTS

A. Document 00 3100 - Available Project Information: Soil investigation data.

B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

C. Section 01 3000 - Administrative Requirements: Submittal procedures.

D. Section 01 6000 - Product Requirements: Requirements for material and product quality.

E. Section 01 6211 - Delegated Design:Requirements for delegated design.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2017.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2019.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2019.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2020.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2015.

1.04 DEFINITIONS

A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.

1. Design Services Types Required:
    a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
    b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.05 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.
   1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
   1. Structural Design of Steel Trusses: As described in Section 05 4400 - Cold-Formed Metal Trusses.
   2. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08 4313 - Aluminum-Framed Storefronts.
   3. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to building structure, physical characteristics, resulting dimensional limitations as described in Section 08 4413 - Glazed Aluminum Curtain Walls.
   4. Design of Structural Components: As described in Section 14 2400 - Hydraulic Elevators.
   5. Structural Design of Seismic Controls: As described in Section 21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
   6. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 21 1300 - Fire-Suppression Sprinkler Systems.
   7. Design of Seismic Component of Structural Supports and Anchors: As described in Section 46 0509 - Piping and Equipment Supports and Anchors.

1.06 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish differnt or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. 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 requirements. Refer uncertainties to Architect for a decision before proceeding.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Weather and temperature conditions.
      h. Type of test/inspection.

i. Date of test/inspection.
j. Results of test/inspection.
k. Interpretations of the test results where applicable.
l. Compliance with Contract Documents.
m. When requested by Architect, provide interpretation of results.
n. Recommendations for retesting and reinspecting.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.08 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock up of exterior walls for each exterior wall type. Mockup shall include typical exterior components such as window openings, roof haunches, and base of wall conditions. for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior (Stand Alone) Mock-up: Construct an integrated exterior mock-up of a portion of the exterior wall assembly as shown on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary. Mock-up will demonstrate the products to be incorporated into the final Work, their installation quality, and interaction.
   1. Size and Scope: As described in individual specification sections and as indicated on the Drawings.
   2. Location: As directed.
   3. Review and acceptance of mock-up does not constitute approval of deviations from the Contract Documents contained in mock-ups unless [engineer] [architect] [consultant] specifically notes such deviations in writing.
   4. The mock-up may not remain as part of the work.

D. Room Mock-ups: Construct room mock-ups as indicated of a typical classroom. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

E. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

I. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

J. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing and Inspection Log:
   1. Prepare a record of tests and inspections. Include the following:
      a. Date test or inspection was conducted.
      b. Description of the Work tested or inspected.
      c. Date test or inspection results were transmitted to Arrchitect.
      d. Identification of testing agency or special inspector conducting test or inspection.
   2. Maintain log at Project site. Post changes and modifications as they occur. Provide acces to test and inspection log for Archtiect's reference during normal working hours.

C. Testing Agency Duties:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Attend preconstruction meetings and progress meetings.
   8. Submit reports of all tests/inspections specified.

D. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

E. Contractor Responsibilities:
   1. Coordination: Coordinate sequence of activities to accomodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accomodate testing and inspection.
   2. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   3. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   4. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.

5. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
6. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
7. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

F. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

G. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of the Owner, described as follows:
1. As specified in individual specification sections.
2. As identified on the Drawings.
3. As listed in he Building Permit approval.

3.06 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.07 DEFECT ASSESSMENT

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials that comply with installation requirements specificed in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durbale seams that are as invisable as possible.

B. Protect construction exposed by or for quality-control service activities.

C. Replace Work or portions of the Work not complying with specified requirements.

D. Repair and protection are the Contractor's responsibility, regardless of the assignment fo the responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

I. Field offices.

1.02 SUBMITTALS

A. See Sections 01 3000 - Administrative Requirements for submittals procedures.

B. Site Plan - Show locations for temporary facilites, utility hook ups, staging areas, and parking areas for construction personnel.

1.03 OPERATION

A. Supervision: Enforce strict disipline in use of temporary facilites. To minimize waste and abuse, limit availabilty of temporary facilites to essential and intended uses.

1.04 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
   1. Comply with all applicable codes and regulations.
   2. Electrical Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. INstall service to comply with NFPA 70.

B. Existing facilities may not be used.

C. New permanent facilities may be used.

D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.05 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.06 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
   1. Comply with all applicable codes and regulations.

B. New permanent facilites may not be used during construction operations.

C. Maintain daily in clean and sanitary condition.

1.07 TEMPORARY HEATING AND VENTILLATION

A. Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

B. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on

completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1.08 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.09 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.10 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.11 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.12 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.13 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

1.14 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site weekly.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.15 FIRE PROTECTION

A. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

1.16 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on drawings.

B. Erect on site at location indicated.

C. No other signs are allowed without Owner permission except those required by law.

1.17 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 12 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 5000

SECTION 01 5639
TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:
1. Section 01 50 00 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 31 10 00 "Site Clearing" for removing existing trees and shrubs.

1.03 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape] or the average of the smallest and largest diameters at a height 54 inches (1372 mm) above the ground line for trees with caliper of 8 inches (200 mm) or greater as measured at a height of 12 inches (300 mm) above the ground.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
   a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
   b. Arborist's responsibilities.
   c. Quality-control program.
   d. Coordination of Work and equipment movement with the locations of protection zones.
   e. Trenching by hand or with air spade within protection zones.
   f. Field quality control.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
1. Indicate extent of trenching by hand or with air spade within protection zones.

C. Samples: For each type of the following:
1. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
   1. Species and size of tree.
   2. Location on site plan. Include unique identifier for each.
   3. Reason for pruning.
   4. Description of pruning to be performed.
   5. Description of maintenance following pruning.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.07 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist-Municipal Specialist as certified by ISA Licensed arborist in jurisdiction where Project is located.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.08 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Moving or parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Backfill Soil: Planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
   1. Planting Soil: Planting soil as specified in Section 329113 "Soil Preparation"

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
   1. Type: Wood and bark chips.
   2. Size Range: 3 inches (76 mm) maximum, 1/2-inch (13 mm) minimum.
   3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements as shown on the drawings

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:
   1. Lettering, Size and Text: As shown on Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.02 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch (25-mm) blue vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
   1. Apply 2-inch (50-mm) uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches (150 mm) of tree trunks.
   2. Install temporary root protection matting over mulch to the extent indicated.

3.03 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
   1. Fencing: Install at locations and as described on the drawings.
   2. Posts: Set or drive posts into ground one-half the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Owner’s Represetnative.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 50 feet (15 m) on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete, and equipment has been removed from the site.
   1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
   2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.04 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 20 00 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.05 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
   1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
   2. Cut Ends: Do not paint cut root ends.
   3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   4. Cover exposed roots with burlap and water regularly.
   5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches (300 mm) outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.06 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
   1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
   2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
   3. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and as indicated on Drawings.
      a. Type of Pruning: Cleaning raising reducing and thinning where indicated.
      b. Specialty Pruning: Structural restoration where indicated.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and dispose of off-site.

3.07 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
   1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.08 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.09 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
   1. Submit details of proposed pruning and repairs.
   2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
   3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Owner’s Representative determines are incapable of restoring to normal growth pattern.
   1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 6 inches (150 mm) or smaller in caliper size.

2. Large Trees: Provide one new tree(s) of 6-inch (150-mm) caliper size for each tree being replaced that measures more than 6 inches (150 mm) in caliper size.
   a. Species: As selected by Owner's Representative.
3. Plant and maintain new trees as specified in Section 329300 "Plants."

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch (50-mm) uniform thickness to remain.

D. Soil Aeration: Where directed by Arborist, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

Camas Ridge Elementary Tree Inventory

Eugene School District 4J
C/o Glenn MacDonald
Eugene, OR 97405
December 22, 2020

RE: Tree Inventory Report

Dear Eugene School District 4J and Mr. Glenn MacDonald,

The following is the tree inventory and report I prepared for Camas Ridge Elementary School. Please let me know if you have any questions or if I can assist with this project as it proceeds.

Sincerely,

Christopher White

ISA Certified Arborist #PN7006-A

Tree Risk Assessment Qualified

Summary

I was contacted by Mr. Glen MacDonald with Eugene School District 4J to complete a tree inventory and report at Camas Ridge Elementary School at 1150 East 29th Avenue in Eugene, Oregon. After agreeing on an assignment, I visited the site on December 21, 2020 to complete field observations and collect data for the report. I returned to the site on January 19, 2021 and again on January 28, 2021 to add additional trees to the inventory per the request of Mr. MacDonald.

A Site Map is included in **Supporting Materials, Appendix A – Site Map** that includes a corresponding number for each tree surveyed. The numbers begin in the northeast corner of the property at the corner of University Street and East 30th Avenue. They proceed counter-clockwise around the perimeter of the property and end with the trees in the courtyard between the two main buildings on the east side. **Trees #46-55** begin at the corner of Harris Street and East 29 and proceed south along Harris Street. Of the 55 trees included in the inventory, 48 were determined to be in "Good" condition, 4 in "Fair" condition, and 3 in "Poor" condition.

The three trees determined to be in "Poor" condition, **Trees #4, #35,** and **#38**, qualify for removal according to Eugene City Code chapter 6.320(1), but may be preserved if they do not conflict with construction activities as they do not present considerable risk in my opinion (a formal Tree Risk Assessment was not completed). Many of the inventoried trees contain broken limbs, deadwood, and compromised branch structure. They can be pruned and maintained for preservation if desired.

Introduction

Background & History

Mr. Glen MacDonald, Construction Project Manager for the Eugene 4J School District, contacted me to request a tree inventory at Camas Ridge Elementary School in Eugene, Oregon. According to Mr. MacDonald, the school is to be torn down and rebuilt in the next couple of years. After a brief discussion, we agreed on the below assignment. I visited the site on December 21, 2020 to complete my field observations, measurements, photographs, and notes.

ADDENDUM: I returned to the site on 1/19/2021 and completed the measurements and observations of Trees #41-45. I returned again on 1/28/2021 to complete measurements for the street trees along Harris Street, Trees #46-55.

Assignment

1. Identify tree species, diameter at standard height (dsh), height, and condition of all trees over 8 inches in diameter within school boundaries.
2. Create a numbering system and site map to aid in tree identification and location.
3. Identify diseased, dead, and unsafe trees (not a Tree Risk Assessment report) following Eugene City Code chapter 6.320(1).
4. Provide a report containing conclusions of the assignment.

Limits of the Assignment

All observations were completed at ground level with basic tools such as a diameter tape, Nikon Action EX 7x35 binoculars, a Samsung Note 9, a Laser Technology Inc. True Pulse 200 rangefinder, a cavity probe, and a trowel. I did not perform any aerial inspections or root crown excavations.

The root flare and lower 12' of **Tree #40** is obscured by English ivy (*Hedera helix*). English ivy can cover defects that may be present in the root crown and/or lower trunk. **Trees #41 – 45** are inside of a gated courtyard and were inaccessible at the time of the site visit. **ADDENDUM: I returned to the site on 1/19/2021 and completed the measurements and observations of Trees #41-45.** Trees that are located in the sidewalk strip, in between a sidewalk and street, are not included as they are assumed to be owned by the City of Eugene. I am unaware of demolition/construction plans and proximity to existing trees.

Observations

Site Observations

The site is a 7.115 acre flat, rectangular lot bordered by East 29th Avenue to the north, University Street to the east, East 30th Avenue to the south, and Harris Street to the west (**Supporting Materials, Appendix A – Site Map**). The school buildings occupy the northeast half of the lot. They consist of two rectangular buildings running north to south on the east side, and three square buildings in the center of the northern half of the lot. The two rectangular buildings are separated by a fenced courtyard containing six trees and various landscape plants. A rectangular blacktop with basketball hoops exists in the south/center of the lot. On the west side is a large soccer field in the southwest corner and a parking lot in the northwest corner.

The majority of the mature trees are along the perimeter, mainly along University Street to the east and E. 29th Avenue to the north. Young trees were recently planted surrounding the

northeast parking area and close to the east side of the easternmost building. They are all under 8 inches d.s.h. and therefore are not included in the inventory.

Subject Tree Observations

Camas Ridge Elementary Tree Inventory, 12/21/2020, 1/19/2021, and 1/28/2021.

Tree #	Species	DSH (Diameter at Standard Height)	Height	Condition (Good, Fair, or Poor)
1	ponderosa pine (*Pinus ponderosa*)	24”	63’	Good
2	Norway maple (*Acer platanoides*)	14”	28’	Good – storm damage
3	Colorado blue spruce (*Picea pungens ‘Glauca’*)	19”	46’	Good
4	Norway maple	10”	30’	Poor – low vigor, trunk wounds
5	silver maple (*Acer saccharinum*)	18”	46’	Good
6	silver maple	21”	46’	Fair – low vigor, scaffold wound, storm damage
7	silver maple	22”	50’	Good
8	silver maple	19”	46’	Good – storm damage
9	silver maple	17”	46’	Good – deadwood, trunk wound
10	silver maple	14”	44’	Good – trunk wound
11	silver maple	20”	34’	Good – trunk wound
12	silver maple	17”	38’	Good – trunk wound

13	sweetgum (*Liquidambar styraciflua*)	11”	46’	Good
14	sweetgum	9”	33’	Good
15	sweetgum	12”	35’	Good
16	sweetgum	11”	30’	Good – storm damage
17	sweetgum	15”	46’	Good
18	sweetgum	10”	35’	Good
19	sweetgum	13”	38’	Good
20	sweetgum	15”	50’	Good
21	sweetgum	14”	53’	Good
22	sweetgum	13”	42’	Good
23	sweetgum	16”	52’	Good
24	sweetgum	18”	62’	Good
25	callery pear (*Pyrus calleryana*)	11”	24’	Good
26	callery pear	10”	24’	Good
27	callery pear	11”	24’	Good
28	callery pear	12”	24’	Good
29	horsechestnut (*Aesculus hippocastanum*)	8”	18’	Good
30	horsechestnut	8”	18’	Good
31	callery pear	8”	19’	Good
32	callery pear	11”	18’	Good
33	callery pear	9”	18’	Good

34	Scots pine (*Pinus sylvestris*)	23”	41’	Good
35	ponderosa pine	21”	39’	Poor – extensive sequoia pitch moth infestation, low vigor **(Photo 5)**
36	tuliptree (*Liriodendron tulipifera*)	20”	49’	Fair – decay column **(Photo 4)**
37	tuliptree	14”	52’	Good
38	bigleaf maple (*Acer macrophyllum*)	9”	20’	Poor – decay, low vigor
39	bigleaf maple	21”	40’	Fair – deadwood, utility-pruned
40	silver maple	35”	70’	Good – English ivy (*Hedera helix*) covering lower trunk **(Photo 3)**
41	silver maple	27”	63’	Good – English ivy covering lower trunk, storm damage
42	silver maple	25”	53’	Good – English ivy covering lower trunk, storm damage
43	silver maple	15”	35’	Good – English ivy covering lower trunk
44	Colorado blue spruce	13”	32’	Good
45	Norway maple	11”	19’	Good
46	Norway maple	10”	36’	Good – old wound at base, sufficient wound wood development
47	Norway maple	10”	40’	Good
48	Norway maple	10”	32’	Good
49	Norway maple	10”	35’	Good

50	Norway maple	10”	35’	Good
51	Norway maple	12”	36’	Good
52	Norway maple	12”	33’	Fair – poor structure
53	Norway maple	13”	27’	Good
54	Norway maple	19”	33’	Good
55	Norway maple	16”	30’	Good

Discussion

As noted in the inventory, **Tree #35**, the ponderosa pine in the southeast corner, has extensive damage due to the sequoia pitch moth (*Synanthedon sequoiae*) (**Supporting Materials, Appendix C - Photo 5**). According to *Insects That Feed on Trees and Shrubs* (Johnson and Lyon), “*S. sequoia* is not likely to threaten the life of a pine. The larvae feed locally just beneath their pitch masses. The masses, and the streaming of pitch down the trunks of trees, however, result in unsightly trees. Some limb breakage has been reported when infestations occur near the slender top of trees or on limbs.” Although *S. sequoia* infestation does not usually result in tree death, it can when coupled with other stressors. This particular tree also exhibits very low vigor and annual growth resulting in the “Poor” rating it was assigned.

Many of the trees, including the majority of **Trees #1-24,** have large trunk wounds at ground level. As they are all surrounded by turf-grass, the damage is most likely caused by string-trimmers. String-trimming too close to tree trunks can remove bark and damage important phloem and cambium tissues. This can result in decay and long-term damage and should be avoided at all costs.

During the site visit, I noticed many trees that were planted relatively recently - most of the trees surrounding the northwest parking lot and seven trees along the eastern side of the easternmost building. If these trees are located within demolition/construction boundaries, they can be relocated to another location due to their young age and small size. Please inquire if you would like more information regarding this matter.

Prior to demolition/construction, it is critical to avoid compaction of root zones and mechanical damage to trunks and limbs from construction equipment. The most effective way is to install 6' fencing around root zones and to prohibit all activity within this area. If roots must be cut, it shall be done with a sharp saw (not with an excavator). Do not allow roots to be exposed for long periods of time, especially in the summer months. Cover large, exposed roots with wet burlap and re-hydrate periodically to avoid root desiccation. Trees should be checked for signs of decline once per year by a certified arborist, for the first 5 years after construction, and every other year for the next 5 years.

Conclusions

According to Eugene City Code chapter 6.320(1), the following trees should be removed "… with respect to disease, hazardous or unsafe conditions, danger of falling, proximity to existing structures…" - **Trees #4, #35, and #38**. This does not include trees within close "proximity to existing structures or proposed construction, or interference with utility services or pedestrian or vehicular traffic safety", since I am unaware of exact demolition/construction details and locations at this time. Although these three trees qualify for removal according to Eugene City Code, in my opinion, none of them pose significant risk due to their size, condition, and locations.

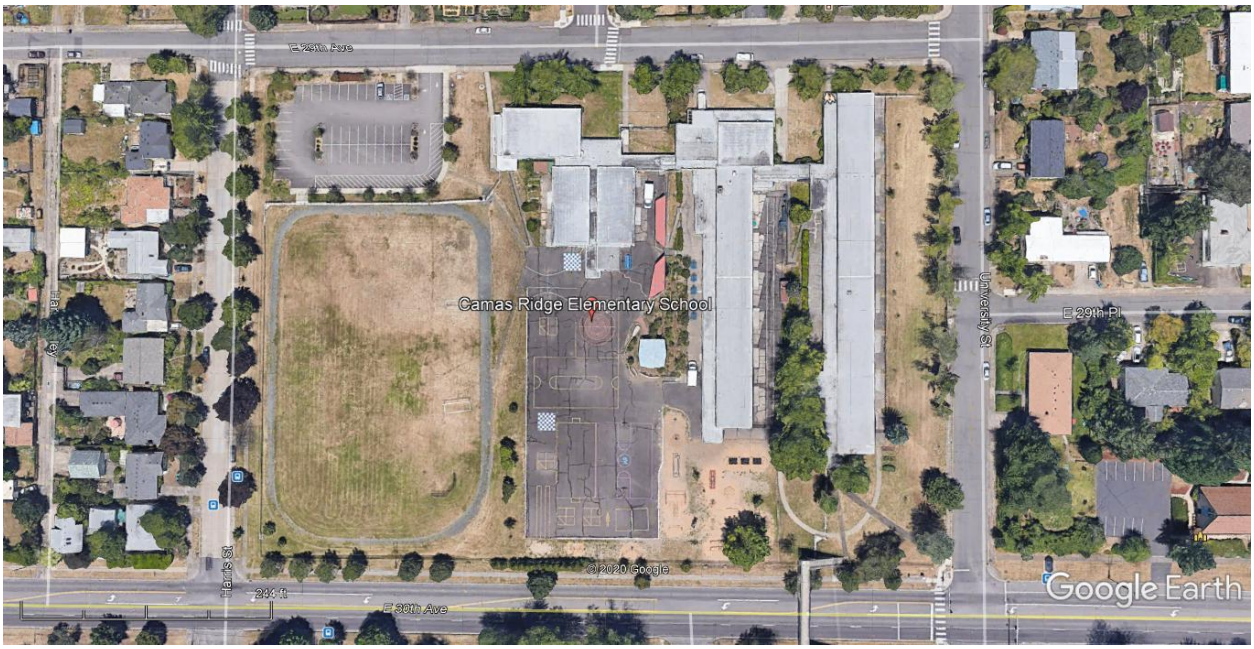
The vast majority of the trees surveyed are in good overall condition and health. Many contain dead and/or broken limbs and compromised form, most likely from the snow storm of 2018.

Recommendations

1. Remove **Trees #4, #35,** and **#38** if they conflict with demolition/construction.
2. Prune trees designated for preservation as follows: Remove deadwood 1" diameter and larger and broken limbs. Reduce length of over-extended laterals to decrease load and improve form. Raise canopy as needed to accommodate demolition/construction.
3. Transplant five dawn redwoods (*Metasequoia glyptostroboides*) and two ponderosa pines located along the eastern side of the easternmost building if their locations conflict with demolition/construction. Transplant young trees surrounding the northwest parking lot if their locations conflict with demolition/construction.
4. Hire an I.S.A. Certified Arborist to assist with tree preservation after plans are finalized.

Supporting Materials

Appendix A – Site Map



Google Earth Image – 7/21/2019

Photo of Google Earth Image with tree numbers – 12/21/2020

Appendix B – City Code 6.320(1)

6.320

Criteria for Permit Issuance.

(1) The city manager or designee shall approve, approve with conditions, or deny a permit application based on consideration of the following criteria:

(a) The condition of the trees with respect to disease, hazardous or unsafe conditions, danger of falling, proximity to existing structures or proposed construction, or interference with utility services or pedestrian or vehicular traffic safety;

(b) The topography of the land and the effect of felling on erosion, soil retention, stability of earth, flow and character of surface waters and streams, protection of nearby trees and windbreaks;

(c) The effect the trees' removal has on the environmental quality of the area, including scenic and wildlife habitat values;

(d) The necessity to remove trees in order to construct proposed improvements, or to otherwise utilize the applicant's property in a manner consistent with its zoning, this code, the comprehensive plan, and other applicable adopted plans;

(e) Fire safety considerations where, in the opinion of the fire marshal, removal is necessary to protect existing or proposed structures;

(f) The adequacy of the applicant's proposals, if any, to plant new trees or native vegetation to mitigate the environmental effects of removal of the trees to be felled; and

(g) That the felling would be compatible with generally accepted principles of horticulture, silvaculture, ecology, or landscape architecture;

(h) The compatibility of the felling with guidelines adopted by the Oregon Department of Forestry.

Appendix C – Photos

Photo 1 – Site trees looking west viewed from corner of University/30th.

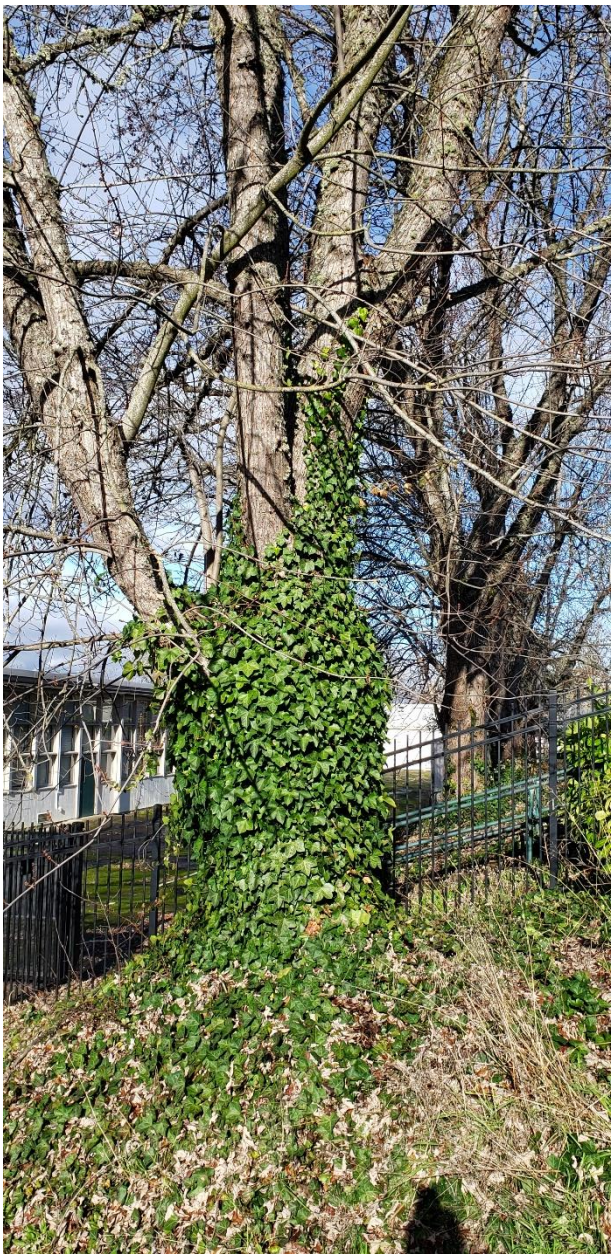
Christopher White Photo – 12/21/2020

Photo 2 – Site trees along University St. viewed looking northwest.

Christopher White Photo – 12/21/2020

Appendix C – Photos (continued)

Photo 3 – English ivy at base of tree #40. .



Christopher White Photo – 12/21/2020

Appendix C – Photos (continued)

Photo 4 – Decay column and wound wood on north side of tree #36.

Christopher White Photo – 12/21/2020

Appendix C – Photos (continued)

Photo 5 – Sequoia pitch moth damage on tree #35.

Christopher White Photo – 12/21/2020

Assumptions and Limiting Conditions

1. Care has been taken to obtain all information from reliable sources. The consultant can neither guarantee nor be responsible for the accuracy of information provided by others.
2. Consultant shall not be required to give testimony or to attend court by reason of this report unless subsequent contractual arrangements are made, including payment of additional fees.
3. Any legal description provided to the consultant is assumed to be correct. No responsibility is assumed for matters legal in character.
4. Missing pages or alteration of this report invalidates entire report.
5. Possession of this report does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior expressed written or verbal consent of the consultant.
6. Neither all nor any part of the contents of this report, nor copy thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the expressed written or verbal consent of the consultant.
7. Information contained in this report reflects the conditions present at the time of inspection.
8. Inspection is limited to visual examination of accessible items without dissection, excavation, probing, or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plants or property in question may not arise in the future.

Respectfully submitted,

Christopher White

PNWISA Certified Arborist # PN-7006A

PNWISA Tree Risk Assessment Qualified

SECTION 01 5719

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality after completion of construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS

A. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2016.

B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.

C. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; 1990.

D. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; 1999.

E. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.04 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

PART 3 EXECUTION

2.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. Do not store construction materials or waste in mechanical or electrical rooms.

D. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.

1. Inspect duct intakes, return air grilles, and terminal units for dust.
2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
3. Clean tops of doors and frames.
4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
5. Clean return plenums of air handling units.
6. Remove intake filters last, after cleaning is complete.

E. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

F. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

2.02 BUILDING FLUSH-OUT

A. Contractor's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:
1. All construction is complete.
2. HVAC systems have been tested, adjusted, and balanced for proper operation.
3. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
4. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot of floor area has been supplied.
1. Obtain Owner's concurrence that construction is complete enough before beginning flush-out.
2. Maintain interior temperature of at least 60 degrees F and interior relative humidity no higher than 60 percent.
3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.
4. If interior spaces must be occupied prior to completion of the flush-out, supply a minimum of 25 percent of the total air volume prior to occupancy, and:
    a. Begin ventilation at least three hours prior to daily occupancy.
    b. Continue ventilation during all occupied periods.
    c. Provide minimum outside air volume of 0.30 cfm per square foot or design minimum outside air rate, whichever is greater.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

2.03 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out, or satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before occupancy.

C. Do not start air contaminant testing until:
1. All construction is complete, including interior finishes.
2. HVAC systems have been tested, adjusted, and balanced for proper operation.
3. New HVAC filtration media have been installed.

D. Indoor Air Samples: Collect from spaces representative of occupied areas:
1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.

2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet; take samples from areas having the least ventilation and those having the greatest presumed source strength.
3. Collect samples from height from 36 inches to 72 inches above floor.
4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
6. When retesting the same building areas, take samples from at least the same locations as in first test.

E. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

F. Analyze air samples and submit report.

G. Air Contaminant Concentration Limits:
1. Formaldehyde: Not more than 27 parts per billion.
2. PM10 Particulates: Not more than 50 micrograms per cubic meter.
3. Total Volatile Organic Compounds (TVOCs): Not more than 500 micrograms per cubic meter.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: Allowable concentrations listed in Table 4-1.
5. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.

H. Air Contaminant Concentration Test Methods:
1. Formaldehyde: ASTM D5197, EPA 625/R-96/010b Method TO-11A, or EPA 600/4-90/010 Method IP-6.
2. Particulates: EPA 600/4-90/010 Method IP-10.
3. Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625/R-96/010b Method TO-1, TO-15, or TO-17.
5. Carbon Monoxide: EPA 600/4-90/010 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.

END OF SECTION 01 5719

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Lists of products to be removed from existing building.

B. Section 01 1000 - Summary: Identification of Owner-supplied products.

C. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

E. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.

1. See Section 01 1000 for list of items required to be salvaged for reuse and relocation.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.
   2. Made of wood from newly cut old growth timber.
   3. Containing lead, cadmium, or asbestos.

C. Packaging:
   1. Where Contractor has the option to provide one of the listed products or equal, preference shall be given to products with minimal packaging and easily recyclable packaging as defined in ASTM D5834.
   2. Maximize use of source reduction and recycling procedures outlined in ASTM D5834.

D. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 01 6116.
   2. If wet-applied, have lower VOC content, as defined in Section 01 6116.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

3.05 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

END OF SECTION 01 6000

SECTION 01 6023

SUBSTITUTION REQUEST FORM

SUBSTITUTION REQUEST: DATE SUBMITTED _____

1.01 SUBMIT TO: PIVOT ARCHITECTURE, 44 WEST BROADWAY #300, EUGENE OR 97401-3038

1.02 PROJECT: CAMAS RIDGE COMMUNITY ELEMENTARY SCHOOL

1.03 SPECIFIED ITEM:

A. SECTION NAME AND NUMBER: _____

B. PRODUCT TYPE AND NAME AND MODEL: _____

C. PARAGRAPH AND PRODUCT DESCRIPTION: _____

1.04 PROPOSED SUBSTITUTION:

A. MANUFACTURER AND MODEL NUMBER(S): _____

B. PRODUCT DESCRIPTION: _____

C. Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request including identification of applicable data portions. Attached data also includes description of changes to Contract Documents the proposed substitution requires for proper installation.

1.05 UNDERSIGNED CERTIFIES FOLLOWING ITEMS, UNLESS MODIFIED BY ATTACHMENTS, ARE CORRECT:

A. Proposed substitution does not affect dimensions shown on the drawings.

B. Undersigned pays for changes to building design, including engineering design, detailing, and construction costs caused by proposed substitution.

C. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.

D. Maintenance and service parts are available locally or readily obtainable for proposed substitution.

1.06 UNDERSIGNED FURTHER CERTIFIES FUNCTION, APPEARANCE, AND QUALITY OF PROPOSED SUBSTITUTION ARE EQUIVALENT OR SUPERIOR TO SPECIFIED ITEM.

1.07 UNDERSIGNED FURTHER CERTIFIES THAT THE MANUFACTURER OF THE PROPOSED SUBSTITUTION IS AWARE OF THIS SUBSTITUTION REQUEST AND AGREES TO THE STATEMENTS NOTED ABOVE.

1.08 UNDERSIGNED AGREES THAT THE TERMS AND CONDITIONS FOR SUBSTITUTIONS FOUND IN BIDDING DOCUMENTS APPLY TO THIS PROPOSED SUBSTITUTION.

1.09 SUBMITTED BY:

A. NAME: _____ SIGNATURE:_____

B. FIRM NAME: _____

C. FULL MAILING ADDRESS: _____

D. PHONE: _____ E-MAIL: _____

1.10 FOR USE BY ARCHITECT OR ENGINEER

A. APPROVED OR APPROVED AS NOTED BY: _____

B. NOT APPROVED BY: _____

C. RECEIVED TOO LATE: _____

D. REMARKS: _____

E. DATE OF RESPONSE: _____

END OF SECTION 01 6023

SECTION 01 6116

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

1.03 DEFINITIONS

A. Interior of Building: Anywhere inside the exterior weather barrier.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

PART 2 PRODUCTS

2.01 MATERIALS

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION 01 6116

SECTION 01 7000

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

K. Substantial Completion

L. FInal Completion

M. Additional fees for delays in completing the work.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

G. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

H. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

I. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
2. Identify demolition firm and submit qualifications.
3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.
6. Include in request:
a. Identification of Project.
b. Location and description of affected work.
c. Necessity for cutting or alteration.
d. Description of proposed work and products to be used.
e. Effect on work of Owner or separate Contractor.
f. Written permission of affected separate Contractor.
g. Date and time work will be executed.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Examination of Existing Conditions:
1. The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
2. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping, and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Use of explosives is not permitted.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

I. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

3.12 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 SUBSTANTIAL COMPLETION

A. Notify Architect when work is considered ready for Substantial Completion.

B. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.

C. Complete all required maintenance work prior to the date of substantial completion.

D. When Contractor considers Work substantially complete, as defined in General Conditions, submit to the Architect:
   1. Written notice that Work, or designated portion thereof, is substantially complete.
   2. List of Items to be completed or corrected.
   3. Copy of Final or Temporary Occupancy Permit.

E. Architect will, as soon as possible thereafter, make an observation visit to the site to determine completion status.

F. Should Architect determine that Work is not substantially complete:
   1. Architect will promptly notify Contractor in writing, giving reasons therefore.
   2. Contractor shall remedy Work deficiencies, and send second notice of substantial completion to Architect.
   3. Architect will review the corrected work.

G. When Architect concurs that Work is substantially complete, Architect will:
   1. Prepare Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected, as verified and amended by Architect.
   2. Submit Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

H. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

3.15 FINAL ACCEPTANCE

A. When Contractor considers Work complete, submit written certification to Architect and Owner that:
   1. Contract Documents have been reviewed.
   2. Contractor has inspected Work for compliance with Contract Documents.
   3. Work has been completed in accordance with Contract Documents.
   4. Equipment and Systems have been tested in presence of Owner's Representative and are operational.
   5. Work is complete and ready for final inspection.

B. Architect will, as soon as possible thereafter, make an observation visit to the site to determine completion status.

C. Should Architect consider Work incomplete or defective:
   1. Architect will promptly notify Contractor in writing, listing incomplete or defective Work.
   2. Contractor shall immediately remedy deficiencies, and send second written certification to Architect that Work is complete.
   3. Architect will review the corrected Work.

D. Notify Architect when work is considered finally complete.

E. When Architect finds Work acceptable under Contract Documents, Architect will request Contractor to make final closeout submittals.

3.16 ADDITIONAL FEES FOR DELAYS IN COMPLETING THE WORK

A. Architect will make 2 visits to the project site, one at Substantial Completion and one at Final Completion.

B. Should Architect be required to make more than the stated 2 final site visits due to Contractor's failure to correct specified deficiencies:
   1. Owner will compensate Architect for additional services.
   2. Owner will deduct Architect's compensation amount from Contractor's final payment as follows:
      a. Principal's time at $175.00 per hour.
      b. Employees' time at $100.00 per hour.
      c. Consultant employees and Others at 1.1 times the direct cost incurred.

3.17 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 01 7000

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

E. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

F. The following sources may be useful in developing the Waste Management Plan:

G. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.

C. Waste Management Plan: Include the following information:
   1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
   2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
   3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
   4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
   5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
   6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

2.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.

3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION 01 7419

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operations and Maintenance Data.

C. Warranties and Bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for Operations and Maintenance data.

E. Individual Product Sections: Warranties required for specific Products or Work.

1.03 SUBMITTALS

A. Substantial Completion will not commence before the Record Drawings, draft of the Operations and Maintenance Manual, and copies of Warranties and Bonds are submitted in accordance with Section 01 7000.

B. Project Record Documents: Submit documents to Architect Prior to Substantial Completion.

C. Operations and Maintenance Data:
   1. Submit one digital copy of preliminary draft or proposed formats and outlines of contents before start of Work preparing the Operations and Maintenance data. Include bookmarks or links illustrating format and organization of digital document. Architect will review draft and return any comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one digital copy of completed draft of the Operations and Maintenance Manual 30 days prior to scheduled date of Substantial Completion. This copy will be reviewed and returned, with Architect comments. Revise content as required prior to final submission.
   4. Final Submittal: Submit one digital copy in PDF file format of revised final documents in final form prior to date of Final Completion.
   5. Either the draft copy or the final copy of the Operations and Maintenance manuals must be on the project site during any of the operator training scheduled for the project.

D. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
   4. Digital copies of the Warranties and Bonds shall be included in the Operations and Maintenance manual.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. During construction, provide access to paper or digital copies of the following record documents; Contractor shall record actual revisions to the Work as construction progresses:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instructions for assembly, installation, and adjusting.

B. Maintenance of documents and samples on the Construction site.
   1. Store in Contractor's Field Office apart from Documents used for Construction.
   2. For Samples and paper copies of Documents used on the construction site, provide Files, Shelving and Cabinets necessary to safely and securely store Documents and Samples.
   3. Maintain paper copies of Documents in a clean, dry, legible, and good order.
   4. Make digital or paper copies of Documents available at all times for Architect's review.

C. Ensure digital or hand written entries are complete and accurate, enabling future reference by Owner.

D. Record information, digitally or by hand, concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications to the Contract.

F. Record Drawings and Shop Drawings: Through digital means or by hand written notes, legibly mark each item to record actual construction including:
   1. Measured depths to top of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and details.
   5. Details not on original Contract Drawings.

3.02 OPERATIONS AND MAINTENANCE MANUAL DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATIONS AND MAINTENANCE MANUAL DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

3. For each paint finish, provide original drawdowns with project name, base name and product number, color name and number, store name and location where mixing occurred, and pigmentation formula.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

F. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

3.04 OPERATIONS AND MAINTENANCE MANUALDATA FOR EQUIPMENT AND SYSTEMS

A. In addition to requirements called for in other sections of the Project Manual, provide the following:

B. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific Products, Equipment and Systems.

D. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

E. Include color coded wiring diagrams as installed.

F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

G. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

H. Provide servicing and lubrication schedule, and list of lubricants required.

I. Include manufacturer's printed operation and maintenance instructions.

J. Include sequence of operation by controls manufacturer.

K. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

L. Provide control diagrams by controls manufacturer as installed.

M. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

N. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

O. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

P. Include test and balancing reports.

Q. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATIONS AND MAINTENANCE MANUALS

A. Assemble the digital copy of Operations and Maintenance data for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide bookmark tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products, equipment and systems.

D. Prepare data in the form of an instructional manual.

E. Digital O&M Manuals:
   1. The digital Operations and Maintenance Manuals shall contain a searchable Table of Contents.
   2. All markup of final PDF documents shall be produced using appropriate PDF software, and not handwritten. Final PDF documents shall not be scanned, but shall be submitted in their original digital form and remain fully searchable using PDF viewing software in common use.
   3. Digital copies of the Operations and Maintenance Manuals must be organized by section with bookmarked tags. For ease of use and digital transfer, divide each specific Specification Division into separate PDF files.

F. Project Directory: Title and address of Project; names, addresses, e-mail addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

G. Arrange content by systems under division and section numbers and sequence of Table of Contents of this Project Manual.

H. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   2. Part 2: Project documents and certificates, including the following:
      a. Final copy of submitted and reviewed Shop Drawings, Schedules, and Product Data.
      b. Air and water balance reports.
      c. Certificates.
      d. Warranties and Bonds.

I. Date: Include the date of assembly, in the format MM/DD/YYYY, on the first page of the document.

3.06 WARRANTIES AND BONDS INCLUDED IN OPERATIONS AND MAINTENANCE MANUALS

A. Obtain Warranties and Bonds, executed by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and when required have been notarized.

C. Co-execute submittals when required.

D. Retain copies of all Warranties and Bonds until time specified for submittal.

E. Include in Operations and Maintenance Manual,

3.07 EVIDENCE OF PAYMENTS & RELEASE OF LIENS

A. Prior to Final Payment Contractor shall submit the following:
   1. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G-706. A copy of this Form is bound in the Appendix Section of this manual.
   2. Contractor's Affidavit of Release of Liens, AIA Document G-706A, bound in the Appendix Section of this manual, including the following:
      a. Consent of Contractor's Surety to Final Payment, AIA Document G-707, bound in the Appendix Section of this manual.
      b. Contractor's Release or Waiver of Liens.
      c. Separate releases or waivers of lien for Subcontractors, Suppliers, and others with lien rights against Owner's Property, together with list of those parties.
   3. Duly sign and execute all Submittals, before delivery to Architect.

3.08 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ARCHITECT

A. Wage Certification: Section 00 7343 and 01 2000.

B. Certificate of Domestic Water Disinfection. See Division 33.

C. Building Official's Certificate of Occupancy.

3.09 SPARE PART & MAINTENANCE MATERIAL SUBMITTALS TO OWNER

A. All spare parts and extra material are to be delivered to the Owner prior to the date of Substantial Completion. Provide written confirmation of delivery, noting quantity and description as well as storage location. Obtain written acceptance from Owner for receipt of stored items.

B. Specific Requirements: See Specifications Sections.

C. Products: Identical to those included in Project Work.

D. Storage Location: Where directed by Owner.

E. Required Submittals: See Specification Sections.

3.10 FINAL ADJUSTMENT OF ACCOUNTS

A. In accordance with the General Conditions, and the Owner/Construction Manager Agreement submit final statement of accounting to Architect and Owner's Project Representative. Include at a minimum the following:
   1. Original Contract Sum.
   2. Additions and deductions resulting from:
      a. Previous Change Orders.
      b. Adjustments to Cash Allowances
      c. Other adjustments.
      d. Deductions for uncompleted Work.
      e. Deductions for Reinspection Payments.
   3. Total Contract Sum, as adjusted.
   4. Previous Payments.
   5. Sum remaining due.

B. Architect will prepare and issue final Change Order, reflecting approved adjustments to Contract Sum not previously made by Change Orders.

3.11 FINAL APPLICATION FOR PAYMENT

A. Follow procedures specified in Section 01 2000.

END OF SECTION 01 7800

SECTION 01 7900

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Landscape irrigation.
   7. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

B. Section 01 9113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.
   3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
   4. Include Commissioning Authority's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:
1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 7900

SECTION 01 9113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. 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.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.

1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
1. No sampling of identical or near-identical items is allowed.
2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
   a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
   b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
   c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
   d. Serial number of installed unit.
   e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
   f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
4. If any Checklist line item is not relevant, record reasons on the form.
5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the

Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
   1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
   2. Examples of Functional Testing:
      a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
      b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
      c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
      d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
   1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
   2. Verify that sensors with shielded cable are grounded only at one end.
   3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
   4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
   1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
   2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
   3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
   1. Disconnect sensor.
   2. Connect a signal generator in place of sensor.
   3. Connect ammeter in series between transmitter and building automation system control panel.
   4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
   5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.

6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. 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 to 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).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.

3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
2. Other points will be monitored by the Commissioning Authority using dataloggers.
3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 - Closeout Submittals 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.

END OF SECTION 01 9113

SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of built site elements.

C. Selective demolition of building elements for alteration purposes.

D. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 00 3100 - Available Project Information: Existing building survey conducted by Owner; information about known hazardous materials.

B. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

C. Section 01 1000 - Summary: Sequencing and staging requirements.

D. Section 01 1000 - Summary: Description of items to be removed or salvaged by Owner

E. Section 01 1000 - Summary: Description of hazardous material abatement work to be completed by Owner prior to demolition under separate contract.

F. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

G. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

H. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

I. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

J. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

K. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

L. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

M. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

N. Section 32 9300 - Plants: Relocation of existing trees, shrubs, and other plants.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2019.

1.04 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS

2.01 MATERIALS

PART 3 EXECUTION

3.01 SCOPE

A. Remove the entire building as shown on the drawings.

B. Remove paving and curbs as required to accomplish new work.

C. Remove all other paving and curbs as indicated on drawings..

D. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

E. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade.

F. Remove concrete slabs on grade within site boundaries.

G. Remove manholes and manhole covers, curb inlets and catch basins as indicated on drawings.

H. Remove fences and gates as indicated on drawings.

I. Refer to drawings for additional demoliton work..

J. Remove other items indicated, for salvage, relocation, and recycling.

K. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2200.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permit.
   6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

F. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

G. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

H. Burning not permitted.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.05 SALVAGE

A. Salvage for Reuse:
   1. Identify materials shown on drawings for removal that can be reused in the project for a similar use and in new locations as shown on drawings.
   2. Coordinate carefully, the removal of items to be reused with the requirements of reinstallation.
   3. It is contractor's responsibility to relocate, properly store and protect all items salved for reuse.

B. Damaged Items:
   1. If items to be reused are damaged during removal, storage or reinstallation, repair or replace with new to match existing condition prior to start of work.

C. Listings of items to be salvaged for reuse as indicated on drawings:
   1. Art murals.
   2. Pink bench.
   3. Wood post.
   4. Skateboard rack.
   5. Existing wood Outdoor Classroom, see 02 4300.

D. Other salvage:
   1. Title to all other material to be removed is vested in the Contractor upon invitation to bid for demo scope..

3.06 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

D. Clean remaining structure, equipment, and facilities of all dirt, dust and debris caused by demolition work. Return areas to conditions existing prior to the start of the work.

END OF SECTION 02 4100

SECTION 02 4300

STRUCTURE MOVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparing structure for move.

B. Moving structure to new location.

C. Setting structure on new foundation.

1.02 RELATED REQUIREMENTS

A. Section 02 4100 - Demolition: Removal of existing foundation after structure removal.

B. Section 31 2200 - Grading: Rough and finish grading.

C. Section 31 2316 - Excavation: Excavating at perimeter of existing foundations in preparation for move.

D. Section 31 2316 - Excavation: Excavating at new site.

E. Section 31 2323 - Fill: Fill materials.

F. Section 31 2323 - Fill: Backfilling against foundation walls at new site.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Move Meeting: Convene one week before starting work of this section. Discuss the following:

1. Method of determining damage to existing structure and finishes before and after the move.
2. Method and responsibility for repairs after moving.
3. Review the intended route for moving and dimensional clearances of obstructions.

1.04 QUALITY ASSURANCE

A. Mover Qualifications: Company specializing in relocating building structures with minimum of three years of documented experience.

B. Retain services of a Professional Structural Engineer experienced in this Work and licensed in the State in which the Project is located for the following:

1. To investigate and provide documented report confirming load bearing capacity of roads over which structure will be moved.
2. To design structural supports for existing structure and associated Work. Design framing, reinforcement, and brace connections to transfer loads of structure to transport carrying timbers.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Transport, Equipment, and Supports: As required to achieve a successful structure move.

B. Fill Materials: As specified in Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify availability and accessibility of transport routes. Verify route load limits to ensure conditions are adequate to support moving loads of structure.

B. Identify utility services and obstructions to be removed, relocated, or abandoned during progress of the Work.

C. Damage Determination:

1. Before the move, inspect existing structure thoroughly and notify Architect in writing of visible defects and factors that could affect safe movement of structure to final location.

3.02 PREPARATION

A. Prepare site, route of transport, and destination site.

B. Reinforce road as necessary to safely move the structure and to prevent damage.

C. Secure supplementary framing and bracing to structure.

D. Protect elements surrounding the structure from damage.

3.03 RAISE STRUCTURE

A. Cut structure free of foundation and portions of structure not being moved.

B. Reinforce, brace, and raise structure clear of foundation in manner to prevent damage.

C. Provide necessary framing, bracing, closures, supports, and blocking.

D. Secure structure to temporary supporting structural members to prevent shifting of structure during move.

3.04 MOVE STRUCTURE

A. Provide transport vehicles for moving structure to new site.

B. Move structure, control speed, and provide anchor and restraining devices to maintain the integrity of the structure.

C. During move, protect adjacent structures, and private and public property from damage.

D. It shall be the Contracotr's responsibility to store and protect existing structure until reinstallation occurs.

3.05 REINSTALL STRUCTURE

A. Position and anchor structure over prepared foundation and lower onto new foundation.

B. Remove moving equipment.

C. Leave reinforcing, framing, and bracing intact until structure is fully attached and structure loads are supported by new foundation.

3.06 TOLERANCES

A. Maximum Variation from Level and Plumb After Reinstallation: 1/4 inch.

B. Maximum Offset from True Position After Reinstallation: 1/4 inch.

C. Adjust structure on foundation:
   1. So that columns are level and plumb.

3.07 DAMAGE REPAIR

A. Repair damage to structure not identified in writing prior to move.

3.08 CLEANING

A. Remove moving equipment and materials from original site, final site, and route of travel.

B. Remove road base constructed by this section, fill and return grades and contours to original condition and dimension.

END OF SECTION 02 4300

SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

E. Waterstops

F. Placement of anchor bolts, embed plates, and anchorages

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 03 3511 - Concrete Floor Finishes: Specially surfaced concrete.

D. Section 05 1200 - Structural Steel Framing: Anchor bolts for Structural Steel.

E. Section 05 5000 - Metal Fabrications: Anchor Bolts for Metal Fabrications and other trades.

1.03 REFERENCE STANDARDS

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

B. ACI 301 - Specifications for Structural Concrete; 2016.

C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2000.

D. OSSC - Oregon Structural Specialty Code, latest edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Chamfer outside corners of columns, pilasters and walls unless otherwise indicated on Drawings.

D. Formwork design and engineering are Contractor's responsibility. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

2.02 WOOD FORM MATERIALS

A. Form Materials:

1. At exposed vertical surfaces: MDO plywood, smooth and free of any surface texture.
2. At other locations: Contractor discretion in accordance with ACI 347.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
   1. Composition: Colorless, reactive, water-based or solvent-based compound.

C. Reveal / Chamfer Strips: Rigid plastic or wood strip type; 3/4 x 3/4 inch size unless otherwise noted on Drawings; maximum possible lengths. Mill wood strips from straight-grained lumber and surface all sides.

D. Embedded Anchor Shapes, Plates, Angles and Bars: As indicated on drawings and specified in Section 05 1200.

E. Waterstops: Expandable Bentonite type. 1 inch wide by 1/2 inch thick (dry), strips of maximum possible lengths, moisture expanding. Provide Superstop manufactured by Tremco, or approved.
   1. Extent: At all cold joints below grade, and elsewhere as shown on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

B. Verify subgrade is at proper depth to accommodate footing and slab thickness.

3.02 EARTH FORMS

A. Earth forms are not permitted.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Unless otherwise indicated, install form ties equidistant and symmetrical, aligned vertically and horizontally

F. Obtain approval before framing openings in structural members that are not indicated on drawings.

G. Provide chamfer strips at the following locations:
   1. External corners.
   2. Locations indicated on Drawings.

H. Coordinate this section with other sections of work that require attachment of components to formwork.

I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete. Do not 'wet set'.

C. Place anchor bolts in accordance with AISC Code of Standard Practice.

D. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Ensure that minimum coverage is provided from waterstop to face of concrete.

G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than three times for concrete surfaces to be exposed to view. Do not path formwork.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 1000

SECTION 03 2000

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; 2016.

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

C. ACI SP-66 - ACI Detailing Manual; 2004.

D. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.

E. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2018.

F. CRSI (DA4) - Manual of Standard Practice; 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
   1. Shop drawing resubmittals shall clearly identify all revisions to previous submittals.
      a. Heavy ink clouded outlines (revisions clouds) shall be drawn around revised areas of individual sheets.
      b. Architect/Engineer will not review information outside of revision clouds on resubmitted drawings.

C. Welders' Certificates: Submit certifications for welders employed on the project, verifing AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

B. Provide 48 hours notice to Architect for review of completed reinforcement. Allow 24 hours for Architect's review. Allow sufficient time in construction schedule for corrections to reinforcement prior to placement of concrete.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcement Steel: As indicated on Drawings.

B. Reinforcing Steel, weldable: All reinforcing steel to be welded or bent in the feild, and as indicated on Structural drawings; ASTM A706/A706M, Grade 60, deformed billet-steel bars, unfinished.

C. Plain Steel Welded Wire Reinforcement (WWR): ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
   1. Mesh Size and Wire Guage: As indicated on the Drawings.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement; avoid damage to underslab vapor barrier where installed.
    a. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRI's "Manual of Standard Practice" of greater compressive strength than concrete.
3. Provide galvanized, plastic or plastic coated components for placement within 1-1/2 inches of weathering surfaces.
4. Mechanical Couplers: As indicated on the Drawings.
5. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice and ACI 318.

B. Welding of reinforcement is not permitted unless shown on Drawings.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

A. General: Comply with CRSI's Manual of Standard Practice for replacing reinforcement.
    1. Do not displace or puncture vapor barrier. 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 would 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 as indicated on teh Drawings. Do not tack weld crossing reinforcing bars.

D. Weld reinforcing bars according to ASW D1.4, where indicated.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Install welded sire fabric in longest practicable lenghts on bar supports to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing plus 2 inches, but no less than 6 inches total. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

G. Do not "wet-set' reinforcing bars or anchor bolts.

3.02 SPECIAL REINFORCEMENT INSTALLATION, UNLESS OTHERWISE SHOWN ON DRAWINGS

A. At Wall Corners and Intersections:
    1. Splice horizontal wall reinforcing with splice bars and corner bars; space and size to match horizontal wall reinforcing.
    2. Extend beyond corner or intersection 48 bar diameters; 24 inches minimum.

B. At Wall Openings:
    1. Provide 2 each #5 bars around Openings; extend vertical bars full wall height and horizontal bars 24 inches minimum beyond opening corners.
    2. Where not possible: Hook bar ends.

C. At Slab Re-entrant Corners:
    1. Provide 1 each, 48 inch long, #4 bar diagonally across re-entrant corner.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION 03 2000

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete for composite floor construction.

B. Footings, stem walls, floors, and slabs on grade.

C. Concrete fill for composite floor construction.

D. Site walls and seating walls.

E. Installation of Epoxy Adhesive Anchors in concrete.

F. Joint devices associated with concrete work.

G. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.

H. Concrete curing.

I. Underslab vapor barriers.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork; placement of anchors and embeds.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

D. Section 05 12 00 - Structural Steel: Grouting under base plates.

E. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

F. Section 32 1313 - Concrete Paving: Sidewalks, curbs and gutters.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; 2016.

C. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

E. ACI 305R - Guide to Hot Weather Concreting; 2010.

F. ACI 306R - Guide to Cold Weather Concreting; 2016.

G. ACI 308R - Guide to External Curing of Concrete; 2016.

H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.

K. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

L. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

M. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.

N. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2019.

O. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.

P. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.

Q. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

R. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

S. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

T. OSSC - Oregon Structural Specialty Code, latest edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: For each concrete mixture, submit proposed concrete mix design a minimum of 15 days prior to the start of Work or Mock-ups. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
   2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing, and requirements of the OSSC.
   3. Identify all materials and admixtures and the proportion of each; indicate mix design for use at areas of Polished Concrete work per Section 03 3511.
   4. Water-cement ratio, slump, and aggregate grading.
   5. Indicate materials sources for principal constituents.
   6. Indicate amount of air entrainment.
   7. Indicate hot and cold weather procedures.
   8. Indicate location(s) and intended use(s).
   9. For exact mix, including all constituents, for use at areas of Polished Concrete work per Section 03 3511, provide test data demonstrating compliance with shrinkage limitation requirements. The mix shall be tested in accordance with ASTM C157 or ASTM C1581.
   10. Indicate whether mix is appropriate for pumping.

D. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.

E. Samples: Submit samples of underslab vapor retarder to be used.

F. Test Reports: Submit report for each test or series of tests specified.

G. Slab Jointing Plan: Show location of slab control joints, closure panels, and slab construction joints not shown on Drawings.
   1. Location of construction joints other than those specifically shown on the Drawings is subject to approval of the Architect.

H. Product Data: Submit manufacturer’s data on epoxy adhesives, concrete expansion anchors and concrete screw anchors.

I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

J. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Concrete Producer Qualifications:
   1. Company specializing in manufacturing ready-mixed concrete products conforming to ASTM C94.
   2. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

E. Installer Qualifications:
   1. Company specializing in work of this Section.
   2. Able to demonstrate minimum of 5 years documented experience in successful quality work of comparable scope and quality when requested by the Architect.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1. Coordinate with Concrete Polishing conference identified in Section 03 3511 – Concrete Floor Finishes.
   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. Owner's representative.
      b. Architect.
      c. Contractor's superintendent.
      d. Independent testing agency responsible for concrete design mixes and floor slab flatness and levelness measurement.
      e. Ready mix concrete manufacturer.
      f. Concrete subcontractor, including supervisor.
      g. Technical representative of liquid-applied product manufacturers.
      h. Applicator of Polished Concrete finish per Section 03 3511.
   2. Review: special inspection and testing and inspecting agency procedures for field quality control; concrete finishes and finishing; cold- and hot-weather concreting procedures; curing procedures; construction contraction and isolation joints, and joint-filler strips; semirigid joint fillers; forms and form removal limitations; shoring and reshoring procedures; vapor-retarder installation; anchor rod and anchorage device installation tolerances; steel reinforcement installation; floor and slab flatness and levelness measurement; coordination with Section 03 3511 for work of this Section to received Polished Concrete finish; concrete repair procedures; and concrete protection.

1.06 MOCK-UP

A. See Section 01 4000 – Quality Requirements, for additional procedures.

B. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment, color, or finish as result of formwork
   1. Panel Size: Sufficient to illustrate full range of treatment.
   2. Locate where directed.

C. Construct mock-up for areas of polished concrete as indicated in Section 03 3511.
   1. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.

D. Construct mock-up of typical section of exterior concrete site wall indicating form-tie treatment, edge conditions, and wall finish.
   1. Locate where directed.
   2. Approved mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 1000.

2.02 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 2000.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I/II, Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.

C. Fly Ash: ASTM C618, Class C or F.

D. Slag: Ground Granulated Blast-Furnace Slag; ASTM C989, Grade 100 or 120.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement. Calcium chloride is not allowed.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
   2. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
   3. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
   4. Retarding Admixture: ASTM C494/C494M Type B.
   5. Water Reducing Admixture: ASTM C494/C494M Type A.
   6. Shrinkage Reducing Admixture: ASTM C494/C494M, Type S.
   7. Crack Reducing Admixture: ASTM C494/C494M, Type S.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs; 15 mils thickness, maximum perm rating of 0.025. The use of single ply polyethylene is prohibited.
   1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   2. Manufacturers:
      a. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
      b. Stego Industries, LLC: www.stegoindustries.com.
      c. Raven Industries; Rufco 3000B, or VaporBlock 15: www.ravenind.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   3. Extent of Use: Under all interior slabs-on-grade, unless otherwise noted.

B. Epoxy Adhesive Anchors for Concrete: As indicated on the Drawings.

C. Expansion and Screw Anchors for Concrete: As indicated on Drawings.

2.06 EPOXY ANCHORING SYSTEM

A. Epoxy resin, ASTM C881, Type IV, Grrade 3, Class B or Class C, Grade 2 may be used in vertical application, Simpson SET-XP Epoxy, Hilti HIT-RE 500SD (at concrete), Hilti HY-150Max (at CMU), or approved.

2.07 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Epoxy Bonding System:
   1. Manufacturers:
      a. Adhesives Technology Corporation; Crackbond SLV302, Crackbond LR321, Crackbond LR321 LPL, Ultrabond 2100 LPL, Ultrabond 2100, Ultrabond 1, Ultrabond 2, Ultrabond 4CC, or Ultrabond HS200.
      b. Dayton Superior Corporation; Slow Set Bonding Agent.
      c. Kaufman Products Inc.; SurePoxy HM EPL.
      d. Kaufman Products Inc.; SurePoxy HM Class B.
      e. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000, or SpecPoxy 3000FS.
      f. W.R. Meadows, Inc.; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000.
      g. Substitutions: See Section 01 6000 - Product Requirements.

C. Waterstops: Bentonite and butyl rubber.
   1. Configuration: As indicated on drawings.
   2. Products:
      a. CETCO, a division of Minerals Technologies Inc; WATERSTOP RX: www.mineralstech.com.
      b. Penetron; Penebar SW-55; www.penetron.com..

D. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   1. Material: ASTM D1751, cellulose fiber.

2.08 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
   1. Manufacturers:
      a. Axim Concrete Technologies; Cimfilm.
      b. BASF Construction Chemicals - Building Systems; MasterKure ER 50.
      c. ChemMasters; Spray-Film.
      d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
      e. Dayton Superior Corporation; Sure Film.
      f. Euclid Chemical Company (the); Eucobar.
      g. Kaufman Products, Inc.; Vapor Aid.
      h. Lambert Corporation; Lambco Skin.
      i. L&M Construction Chemicals, Inc.; E-Con.
      j. Meadows, W.R., Inc.; Sealtight Evapre.
      k. Metalcrete Industries; Waterhold.
      l. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
      m. Sika Corporation, Inc.; SikaFilm.
      n. Symons Corporation, a Dayton Superior Company; Finishing Aid.
      o. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
      p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
      q. Substitutions: See Section 01 6000 - Product Requirements.
      r. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
      s. Moisture-Retaining Sheet: ASTM C171.
         1) Curing paper, regular.

2) Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
3) White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

B. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Sheet: ASTM C171.
1. Curing paper, regular.
2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

D. Water: Potable, not detrimental to concrete.

2.09 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
1. Except as otherwise indicated, replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
2. Supplier is responsible for achieving or exceeding concrete design strengths.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
1. Use water-reducing (plasticizer) or high-range water-reducing (superplasticizer) admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions, and only when approved by Architect.
3. Use water-reducing admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.50.
4. Use shrinkage-reducing admixture or crack-reducing admixture as needed to meet shrinkage or initial crack width limitations indicated.

D. Normal Weight Concrete:
1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: As indicated on drawings.
2. Maximum Water-Cement Ratio: As indicated on the Drawings, except as otherwise noted.
3. Total Air Content: At exterior horizontal surfaces permanently exposed to weather or where concrete flatwork may be subjected to freezing temperatures in a temporary condition, add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content 5% +/- 1% by volume, as determined by ASTM C173.
a. Air-entraining admixture shall not be used in concrete mixes for floors that are to receive a hard-troweled finish
4. Areas of polished concrete finish work per Section 03 35 11: Use only one mix design. Inclusion of admixtures, plasticizers, slag, silica fume, fly ash, or other products replacing portions of the Portland cement in this mix shall comply with the recommended limitations of the Concrete Polishing Council (CPC), a Specialty Council of the American Society of Concrete Contractors. Concrete used in this application shall exhibit a maximum shrinkage of 0.035% at 28 days when tested in accordance with ASTM C157. Alternatively, in lieu of the maximum shrinkage limitation, concrete used in this application shall exhibit a maximum initial crack width of 0.010 inch when tested in accordance with ASTM C1581. Shrinkage and/or initial crack width testing shall be completed by a qualified laboratory.
a. Slump Limit: 5 inches, +/- 1 inch.

b. Maximum Water-Cementitious Materials Ratio: 0.45.
c. Provide evidence of prior success with slabs of polished concrete similar to that required for the Work.

2.10 MIXING

A. Transit Mixers: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 degrees F., reduce mixing and delivery time from 90 minutes to 75 minutes; when air temperature is above 90 deg. F., reduce mixing and delivery to 60 minutes.

B. Adding Water: Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

PART 3 EXECUTION

3.01 FORMWORK

A. Refer to Section 03 1000.

3.02 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.03 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Verify that Surfaces to receive Vapor Barrier are clean, solid, free of projections and otherwise properly prepared.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
2. Use latex bonding agent only for non-load-bearing applications.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

F. Vapor Barrier at Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.04 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.05 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 48 hours prior to commencement of placement operations.

D. Before placing concrete, verify that installation of formwork, reinforcement, inserts, embedded parts, and formed construction joint devices is complete, that required inspections and structural observations have been performed, and these items will not be disturbed during concrete placement.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

G. 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 (4.4 deg C) 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.

H. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F (32 deg C) 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 moisture uniform without standing water, soft spots, or dry areas.

I. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.06 SLAB JOINTING

A. Locate joints as indicated on drawings and approved joint layout submittals.
   1. Contraction joints are not required at composite floor construction.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. 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, only as noted on the Drawings. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

D. Contraction Joints in Slabs-on-Grade: Saw weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints to depth as shown on the Drawings as follows:
   1. Sawed Joints: Create contraction joints with power saws as indicated below. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
      a. Equipment Control Joint Saw: "Soff-Cut System," early-entry dry-cut saw with Skid Plate, by Soff-Cut. 1112 Olympic Drive, Corona, CA 92881 909-272-2330.
      b. Comply with the Soff-Cut instructions for the SOFF-CUT System, except as noted below.
      c. Troweled Finish: Install cuts at each joint location no earlier than 4 hours and no later than 12 hours after concrete placement.
      d. Remove debris in path of cut and under Skid Plate before cutting. Skid Plate must remain flat on surface.
      e. Use Soff-Cut blades and Skid Plates, using a new Skid Plate with each new blade.
      f. Install Soff-Cut joint protector at saw-cut intersection prior to cross-cut.
      g. Remove dry powder without disturbing finish.
      h. Avoid traffic across saw cut until sufficient strength is gained to protect joint edges.

i. Coordinate with Work of Section 03 3511 for placement of contraction joints within areas of polished concrete work.

E. Isolation Joints in Slabs-on-Grade: After removing formwork, install preformed joint filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07 92 00 - 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.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. General: Levelness requirements do not apply where sloped surface is required.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
   1. Slabs on Grade:
      a. 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; for slabs that receive floor coverings.b. Specified overall values of flatness, F(F) 50; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24, for polished concrete floors.
   2. Elevated Slabs, including Slabs on Metal Deck:
      a. Specified overall values of flatness, F(F) 25; with minimum local values of flatness, F(F) 17; for slabs that receive floor coverings.
      b. Specified overall values of flatness, F(F) 35; with minimum local values of flatness, F(F) 24; for polished concrete floors.

C. Ramps: Provide maximum slope as described in Drawings, but not to exceed 1:12 when measured with a 24 inch level at any point in the direction of slope.

D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10, whichever is greater.
   1. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified by the Architect. Re-measure corrected areas by the same process.

3.08 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form 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.

C. Exposed Form 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. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. 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.

E. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.

2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.3. Surfaces to Receive Wood Athletic Flooring: Smooth "steel trowel" as described in ACI 302.1R.
3. Exterior Steps and Ramps: "Broom Finish." Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
4. Surfaces to Receive a Polished Concrete Finish: Trowel as described in ACI 302.1R; use steel-reinforced plastic trowel blades instead of steel blades to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed and surfaces to be polished.
5. The addition of water to the surface during finishing shall not be permitted.
6. Refer to Section 03 3511.

F. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

G. Slabs-on-Metal Deck: Account for deflection of metal deck during placement of wet concrete such that top of slab elevation is screeded off level between column supports. Refer to the General Structural Notes of the Structural Drawings.
1. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.09 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts, nosings and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

E. Concrete Fill for Bollards: Fill bollards with concrete. Smooth trowel concrete to one inch high convex curve at top of bollards unless otherwise indicated on Drawings.

3.10 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Evaporation Reducer: Apply to unformed concrete surfaces to inhibit excessive or rapid free water (bleedwater) loss. Apply according to manufacturer’s written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
1. Apply evaporation reducer to all unformed concrete surfaces of slabs to receive special finish work of Section 03 3511.
2. Apply evaporation reducer to other slabs if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m 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. Cure concrete according to ACI 308.1 by one or a combination of the following methods, maintaining concrete with minimal moisture loss at relatively constant temperature for a total curing period not less than 7 days.

D. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

E. Surfaces to receive polished concrete finish per Section 03 35 11: Protect slabs from wind by providing curtains adjacent to areas being cured during initial curing period.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm. Notify Architect and Testing Lab at least 48 hours before intended concrete placement.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. Inspections: As indicated on the Drawings.

F. Compressive Strength Tests: As indicated on the Drawings and below.
   1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
   2. 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.
   3. 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.
   4. 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 or by other methods as directed by Architect.
      a. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
      b. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

G. Floor flatness and levelness should be tested in accordance with ASTM E1155 after total curing period is complete.
   1. Report both composite overall values and local values for each measured section.

3.12 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.
   1. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

2. 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.
    a. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. 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.b. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match 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.
    b. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
3. 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.
    a. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
    b. After concrete has cured at least 14 days, correct high areas by grinding.
    c. 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.
    d. 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.
    e. 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 (6 mm) 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.
    f. Repair defective areas, except random cracks and single holes 1 inch (25 mm) 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 3/4 inch (19 mm) 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.
    g. Repair random cracks and single holes 1 inch (25 mm) 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.
    h. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

B. For concrete floors indicated to remain exposed to view, protect to prevent damage, including staining, gouges and scratching by construction traffic and activities.
   1. Inspect tires for debris prior to use on slab. Remove embedded items which may cause damage to the floor slab.
   2. Clean up spills on slab immediately.

C. Develop a concrete protection procedure which addresses the following:1. Communication of protection plan to subcontractors and vendors.
   1. Procedures for cleaning spills, including use of and availability of cleaning chemicals and absorptive materials at site.

D. Concrete to Receive Special Finishes: Refer to Section 03 3511.

END OF SECTION 03 3000

SECTION 03 3511

CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs: Polished Concrete

B. Liquid densifiers and hardeners.

C. Polished concrete.

D. Sealer/hardener: SLR

E. Concrete Stains: CS

F. Moisture Mitigation Coating.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.03 REFERENCE STANDARDS

A. ACI 302. 1R, Guide for Concrete Floor and Slab Construction.

B. ASTM D523 – Standard Test Method for Specular Gloss.

C. ASTM D5767 – Standard Test Method for Instrumental Measurement of Distinctness-of-Image (DOI) Gloss of Coated Surfaces.

D. ANSI/NFSI B101.3 – Test Method for Measuring Wet DCOF of Common Hard-Surface Floor Materials.

E. CPC – Concrete Polishing Council, a Specialty Council of the American Society of Concrete Contractors.

1.04 DEFINITIONS

A. Polished Concrete: The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss. For the purposed of this specification, Polished Concrete shall be defined as follows:

1. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, and polishing a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with Section 03 3000 for concrete floor placement and concrete floor curing.

B. Concrete polishing subcontractor to review and comment on slab mix design and concrete finishing and curing methods; provide feedback to architect and general contractor.

1.06 PERFORMANCE DESCRIPTION

A. Performance Criteria:

1. Appearance Level: As defined by CPC and as follows:
   a. Appearance Level [1, Flat (Ground)][2, Satin (Honed)][3, Polished][4, Highly Polished].
      1) Image Clarity Value, %: ASTM D5767; achieve an average distinction of image (DOI) value between [0-9][10-39][40-69][70-100], measured prior to application of sealers.
      2) Haze Index: ASTM D4039; achieve an average value less than 10, measured prior to application of sealers.
2. Aggregate Exposure: As defined by CPC and as follows:
   a. Class [A, Cream][B, Fine Aggregate][C, Medium Aggregate][D, Large Aggregate].

3. Coefficient of Friction:
    a. ANSI B101.3, Dynamic Coefficient of Friction (DCOF): Not less than a minimum of 0.42 (wet).

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
    1. Certification of Mix Design by Polished Concrete Applicator.
    2. Finishing Equipment: Provide equipment type, size, role in finishing process, and demonstrate suitability of specific equipment.
    3. Slip Resistance of Finished Floor: Test data for representative sample of similarly finished concrete using applicator's system and equipment, demonstrating compliance with slip resistance requirements.

C. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 - Quality Assurance article below.
    1. Include letter of certification from concrete finish manufacturer stating that installer is certified applicator of specified concrete finishes and is familiar with proper procedures and installation requirements required by the manufacturer.
        a. Submit documentation for five previous projects including equipment, manufacturer system, and methods used and the name of the applicators, complete information on finishing process, and photographic documentation of finish from original surface to completion.

D. Concrete Floor Protection Plan: Submit methods, products and jobsite implementation plan to provide post-placement and post-polishing protection of slabs to receive a Polished Concrete finish.

E. Test Reports.

F. Maintenance Data: Provide data on maintenance and renewal of applied finishes.
    1. Include manufacturer’s instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
    2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.08 PRE-INSTALLATION MEETINGS

1.09 MOCK-UP

A. Slab on Grade: Form, reinforce, and cast a minimum 120-square-foot sample panel. Incorporate the same subgrade prep, sub-base material, vapor retarder, reinforcing, slab thickness, and concrete mix design as that of the final work. Incorporate sample of joint pattern and hand tool finishing as directed.

B. Mock-Up may remain as part of the final work only if explicit directions to do so are given by the Owner and Architect.

1.10 QUALITY ASSURANCE

A. Manufacturer Qualifications:
    1. Experience: Company experienced in performing specified work similar in design, products, and extent of scope of this project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
    2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress and has experience completing projects similar to that of the final Work.

B. Concrete Polisher Qualifications: Company specializing in performing the work of this section with minimum five years experience with similar applications, and certified by polishing system manufacturer.

C. Preinstallation Conference: Conduct conference at Project site prior to placing concrete for mockups and for areas scheduled for final polishing work.
   1. Required Attendees:
      a. Owner.
      b. Architect.
      c. Structural Engineer, if applicable.
      d. Contractor, including supervisor.
      e. Concrete polisher, including supervisor.
      f. Technical representative of liquid applied product manufacturers.
   2. Minimum Agenda:
      a. Mockup requirements.
      b. Approved submittals.
      c. Environmental requirements.
      d. Scheduling and phasing of work.
      e. Coordinating with other work and personnel.
      f. Protection of adjacent surfaces.
      g. Surface preparation.
      h. Dust control.
      i. Repair of defects and defective work prior to installation.
      j. Cleaning.
      k. Installation of polished floor finishes, including procedural steps of grinding, honing and polishing operations.
      l. Application of liquid hardener, densifier.
      m. Protection of floor surfaces prior to polishing or application of dye.
      n. Protection of finished surfaces after installation.
   3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

D. Preconstruction Mockups: Before casting concrete in final work, produce field sample panels to demonstrate the approved range of selections made under Sample submittals and to demonstrate the expected range of finish, color, and appearance variations.
   1. Slab on Grade:
      a. Form, reinforce, and cast a minimum 120-square-foot sample panel.
      b. Incorporate the same subgrade preparation, sub-base material, vapor retarder, reinforcing, slab thickness, and concrete mix design as that of the final Work.
      c. Incorporate sample of joint pattern and hand tool finishing as directed.
   2. Elevated Slab on Metal Deck:
      a. Construct a minimum 120-square-foot field mock-up of elevated metal floor deck condition.
      b. Securely chair and/or support metal deck atop a level surface in such a fashion as to match a typical two- or three-span condition of the final Work.
      c. Incorporate the same metal deck, reinforcing, slab thickness, and concrete mix design as that of the final work.
   3. Final number, sizes and locations of mock-ups shall be approved in advance by the Architect and Owner.
   4. Provide separate mock-ups for each specified Appearance Level, each specified Aggregate Exposure Class, and each dyed color.
   5. Notify Architect and Owner seven (7) days in advance of dates and times when mock-ups will be constructed.
   6. Placement, curing, finishing and protection work shall match that of final Work and shall be performed by the same personnel as will place and finish the final Work.
      a. Mock-ups shall demonstrate dust control measures.
   7. Approval of mock-up(s) will be by the Architect and Owner based on the aesthetic qualities and on the following:
      a. Compliance with approved submittals.

b. Compliance with specified Appearance Level.
c. Compliance with specified Aggregate Exposure Class.
d. Compliance with specified dynamic coefficient of friction.

8. When directed, demonstrate repair techniques on the mock-up(s). Only approved techniques shall be used in the final Work.
9. Obtain Architect's and Owner's approval before starting the final Work. Approval of mockups does not constitute approval of deviations from Contract Documents unless Architect specifically approves deviations in writing.
10. Protect and maintain approved field mock-up(s) during construction in an undisturbed condition as a standard for judging the completed final Work.
11. Mock-up may remain as part of the final Work only if explicit directions to do so are given by the Owner and Architect.
    a. Demolish and remove field sample panels when directed.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

PART 2 PRODUCTS

2.01 DENSIFIERS AND HARDENERS

A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
   1. Composition: Sodium silicate. Odorless, colorless, waterborne solution, compliant with project's VOC requirements.
   2. Products:
      a. Ardex Engineered Cements; www.ardexamericas.com.
      b. Curecrete Distribution, Inc.; Ashford Formula: www.ashfordformula.com.
      c. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
      d. Master Builders Solutions by BASF; Kure-N-Harden: www.master-builders-solutions.basf.us/en-us/#sle.
      e. Euclid Chemical Company; Diamond Hard: www.euclidchemical.com.
      f. L&M Construction Chemicals, Inc; Seal-Hard: www.lmcc.com.
      g. Nox-Crete; Duro-nox.
      h. Vexcon Chemical; Starseal PS Clear.
      i. W. R. Meadows, Inc; Liqui-Hard: www.wrmeadows.com/#sle.
      j. Substitutions: See Section 01 6000 - Product Requirements.

2.02 POLISHED CONCRETE SYSTEM

A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.
   1. Acceptable Systems:
      a. Ardex Engineered Cements; ULTRAFLOR Polished Concrete System.
      b. HTC Superfloor.
      c. Husqvarna Hiperfloor.
      d. L&M Construction Chemicals, Inc., a subsidiary of Laticrete International, Inc.; FGS Permashine Concrete Polishing System.
      e. L.M. Scofield Company; SCOFIELD® Formula One™ Ground & Polished Concrete Systems.
      f. Retro-Plate 99, by Advanced Floor Products.
      g. W.R. Meadows, Inc; Induroshine.
      h. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Patching Compound: Compound composed of 40 percent Portland cement, 45 percent limestone, and 15 percent vinyl acetate copolymer, when mixed with dust salvaged from grinding process forms a paste that hardens when surface imperfections are filled.

B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.
   1. Products:
      a. VersaFlex Quick Mender; VersaFlex, Inc.
      b. Substitutions: See Section 01 6000 – Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 PREPARATION

A. Prepare and clean concrete surfaces. Provide concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, rust, and other contaminant incompatible with liquid applied products and polishing.

3.03 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
   1. Provide polished concrete floor treatment in entirety of slab areas indicated on the Drawings. Provide consistent finish in all contiguous areas.
   2. Finish to within 1/8 inch of vertical surfaces.3. Apply floor finish prior to installation of fixtures and accessories.
   3. Final polished concrete floor finish shall meet the performance criteria OF this Section and approved mockup(s) before addition of any sealer or coating, regardless of whether that is also specified or not.

3.04 ADJUSTMENTS AND REPAIRS

A. At the direction of the Architect and Owner, re-polish as needed those areas that do not meet the specified Appearance Level and/or Aggregate Exposure.

B. Utilize patching compound and/or grout material where appropriate to repair finished surfaces containing defects.
   1. Do not use patching mortar, repair underlayment or any other repair topping unless specifically directed by the Architect.

3.05 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified testing agency to perform field tests and prepare test reports.

B. Tests:
   1. Image Clarity Value: ASTM D5767, well-distributed across Polished Concrete surfaces prior to application of sealers; a minimum of three (3) tests for areas up to 1,000 square feet, with one (1) additional test for each additional 1,000 square feet or fraction thereof.
   2. Haze Index: ASTM D4039, well-distributed across Polished Concrete surfaces prior to application of sealers; a minimum of three (3) tests for areas up to 1,000 square feet, with one (1) additional test for each additional 1,000 square feet or fraction thereof.
   3. Dynamic Coefficient of Friction: ANSI B101.3.

3.06 CLEANING

A. Keep premises clean and free of debris at all times.

B. Remove spatter from adjoining surfaces, as necessary.

C. Repair damages to surface caused by cleaning operations.

D. Remove debris from jobsite. Dispose of materials in separate, closed containers in accordance with local regulations.

3.07 PROTECTION

A. After completion of polishing, protect polished floors from subsequent construction activities. Cover with breathable product such as kraft paper or thin curing blanket. Do not cover with Masonite, plywood or polyethylene sheets.
   1. Do not tape protection to finished floor surfaces.
   2. Provide signage near floor surfaces to receive a Polished Concrete finish indicating that adjacent floors will remain exposed in final condition and identifying any work limitations.

END OF SECTION 03 3511

SECTION 03 4500
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete stair treads and landings - PC-1

B. Architectural precast wall caps units.

C. Supports, anchors, and attachments.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.

B. Section 03 3000 - Cast-in-Place Concrete: Admixtures and sealer SC-2 for precast stairs.

C. Section 04 2000 - Unit Masonry: Wall construction at Utility Court.

D. Section 05 5100 - Metal Stairs: Metal stairs supporting precast treads and landings.

E. Section 07 1900 - Water Repellents: Sealing of exterior precast units.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

F. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

G. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric].

H. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

I. ASTM C150/C150M - Standard Specification for Portland Cement.

J. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.

K. ASTM C666 - Rapid Freeze/Thaw Resistance of Concrete.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel.

M. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society.

N. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; Precast/Prestressed Concrete Institute.

O. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute.

P. PCI MNL-122 - Architectural Precast Concrete; Precast/Prestressed Concrete Institute.

Q. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute.

R. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; Precast/Prestressed Concrete Institute.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.05 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials.
   1. Include details of mix designs.
   2. Include coordination with metal stairs.

D. Samples: Submit two, 12 x 12 inch in size, illustrating surface finish, color and texture.

E. Selection Samples: For each type and finish of extruded nosing.

F. Fabricator qualifications.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications:
   1. Firm having at least 5 years of documented experience in production of precast concrete of the type required.
   2. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and category A1 - Architectural Precast Concrete.
   3. Plant certified under Architectural Precast Association Plant Certification Program for production of architectural precast concrete.

B. Welder: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

1.07 MOCK-UP

A. Provide mock-up of stair treads, full stair width by full tread depth wide, with finish in accordance with approved sample.
   1. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 STAIR TREADS

A. MANUFACTURERS
   1. Architectural Precast Concrete:
      a. Knife River Corporation; www.kniferiver.com.
      b. Micheal's Precast Concrete: www.michaelsprecastconcrete.com.
      c. Olympian Precast, Inc.; www.olyprecast.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. PRECAST UNITS
   1. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
      a. Concrete Face Mix: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent; comply with ACI 301.

C. REINFORCEMENT
   1. Comply with requirements of Section 03 2000 and manufacturer's recommendations as required to meet performance requirements.

D. CONCRETE MATERIALS
   1. Cement: ASTM C150, Type I - Normal Portland type.
   2. Fine and Coarse Structural Aggregates: ASTM C 33.

3. Water: Clean and not detrimental to concrete.
4. Air Entrainment Admixture: ASTM C260/C260M.
5. Grout:
    a. Non-shrink, non-metallic, minimum 10,000 psi, 28 day strength.

E. FORMWORK
1. Provide forms with acceptable form facing materials that are non-reactive with concrete or form release agents and that will produce required finish surfaces.
2. Construct and maintain forms to produce precast concrete units of shapes, lines and dimensions indicated within specified tolerances.
3. Provide forms to result in a consistent finish with no visible seams in precast surfaces.

F. SUPPORT DEVICES
1. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
    a. Clean surfaces of rust, scale, grease, and foreign matter.
    b. Galvanize after fabrication in accordance with requirements of ASTM A123/A123M.
2. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563 (A 563M) nuts and matching washers.

G. FINISH - PRECAST UNITS
1. Finish - Stair Treads: Acid etch finish. Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.
2. Ensure exposed-to-view surfaces of precast units are uniform in color and appearance and consistent with approved samples.
3. Provide sand blasted nosing strip 2 inch wide along leading edge of tread.

2.02 WALL CAPS

A. MANUFACTURERS
1. Stepstone, Inc.; www.stepstoneinc.com
2. Substitutions: See Section 01 6000 - Product Requirements.

B. MATERIALS
1. Precast concrete wall cap units shall be precast concrete, consisting of Portland cement, aggregate, and color admixtures.
    a. Portland cement: ASTM C 150, Type III, high early strength.
    b. Aggregate: ASTM C 33.
    c. Color Admixture: By Davis Colors, or equal, as required to achieve color as selected.
    d. Portland Cement Mortar that meets or exceeds ANSI A118.4 requirements when mixed with water or a latex admixture, and is designed for installation of large format tile – Pedestrian Installation.
    e. Grout that meets or exceeds ANSI A118.7 when mixed with water or a latex admixture.

C. PRECAST UNITS
1. Sonorastone Peaked wall cap
2. Size: 12-1/4 inch by 24 inches by 3-1/2 inch
3. Finsih: Slate
4. Color: 1504 French Gray

D. EXTENT OF WORK
1. At Utility Court wall and as shown on drawings.

2.03 ACCESSORIES

A. Bearing Pads: As recommended by manufacturer.

B. Sealant: Silicone type specified in Section 07 90 05.

2.04 FABRICATION

A. Fabricate in conformance with PCI MNL-117 and PCI MNL-135.

B. Maintain plant records and quality control program during production of precast units. Make records available upon request.

C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

D. Provide sand blasted nosing as indicated on drawings.

E. Maintain consistent quality during manufacture.

F. Fabricate connecting devices, plates, angles, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

G. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

H. Locate hoisting devices to permit removal after erection.

I. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

J. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.05 FABRICATION TOLERANCES

A. Conform to PCI MNL-117 and PCI MNL-135.

2.06 SOURCE QUALITY CONTROL

A. Provide testing of concrete mix. Comply with testing requirements specified in Section 03 30 00 - Cast-in-Place Concrete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that stair framing is ready to receive Work of this Section.

3.02 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. Fasten stair tread units in place with mechanical connections.

E. Provide non-combustible shields during welding operations.

F. Touch-up field welds and scratched or damaged primed painted surfaces.

G. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances.

H. Seal perimeter joints in accordance with Section 07 90 05.

I. Coordinate with Work of Section 03 30 00 - Cast-in-Place Concrete for application of sealers on stair treads and platforms. Protect all surfaces from staining until surfaces have been sealed.

3.03 SEALING OF EXTERIOR UNITS

A. Field-applied water repellent over the the entire area, including joints, after installation is mandatory in order to maintain product warranty. Follow water repellent manufacturer’s instructions for application and maintenance of the sealer.

B. See section 07 1900 Water Repellents.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135.

END OF SECTION 03 4500

SECTION 04 2000

UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block for structural applications.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

C. Section 04 2001 - Masonry Veneer: Brick veneer over various substrates.

D. Section 07 1900 - Water Repellents.

E. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.

B. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.

C. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2014.

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

H. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

I. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

J. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013.

K. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2008).

L. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2014.

M. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, mortar, and masonry accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, reinforcing, size and type of fasteners, and accessories for unit masonry system.

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI SP-66. Show elevations of reinforced walls.
2. Masonry Units: Show sizes, profiles, coursing and locations of special shapes.

D. Manufacturer's Certificate: For each type and size of the following:
   1. Masonry units. Include data on material properties.
   2. Integral water repellant used in masonry units. Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
   3. Cementitious materials. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Preblended dry mortar mixes. Include description of type and proportions of ingredients.
   6. Grout mixes. Include description of type and proportions of ingredients.
   7. Anchors, ties, and metal accessories.

E. Mix Designs: Provide the following for each type of mortar and grout:
   1. One of the following for each mortar mix:
      a. Mix designs indicating type and proportions of ingredients in compliance with the Proportion Specifications of ASTM C270.
   2. One of the following for each grout mix:
      a. Mix designs indicating type and proportions of the ingredients according to the proportion requirements of ASTM C476.

F. Cold-Weather and Hot-Weather Procedures: Submit detailed description of methods, materials, and equipment to be used to comply with requirements.

G. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

H. Samples: Submit two samples of decorative block units to illustrate color, texture, and extremes of color range.

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Installer: Company specializing in performing the work of this Section with minimum three years documented experience.

C. Advance notices: Notify Architect and Testing Lab at least 48 hours before Grout placement.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements for general requirements for mock-up.

B. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.

C. Show masonry color range and pattern, texture, typical coursing, bond, reinforcing, joint treatment, mortar color, angled and square corner construction, wall-top stepping, etc.

D. Accepted mockups represent minimum acceptable workmanship standard.

E. Locate where directed.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. 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.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build or frozen substrates. Remove and replace masonry damaged by frost or

by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.

B. Cold-Weather Cleaning: Use liquid cleaning methods only when temperature is 40 deg F and higher and will remain so until masonry has dried but not less than seven days after completing cleaning.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops net-area compressive strength at 28 days as indicated on the Drawings.

B. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.02 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, and other detailed conditions. Field cut stretchers to make Bond Beams in CMU to assure color uniformity.
   3. Load-Bearing Units: ASTM C90, medium weight.
      a. Hollow block.
      b. Minimum compressive unit strength: As indicated on the Drawings.
      c. Maximum moisture content 40 percent.
      d. Exposed faces: Plain face, Split face, and Ground face where indicated on Drawings.
      e. Color: As scheduled.
   4. Non-Loadbearing Units (Veneer): ASTM C129.
      a. Solid block, as indicated.
      b. Exposed faces: Plain face, Split face, and Ground face where indicated on Drawings.
      c. Color: As scheduled.
   5. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
      a. Performance of Units with Integral Water Repellent:
         1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
            (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
         2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
         3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
         4) Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
      b. Use only in combination with mortar that also has integral water repellent admixture.
      c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Water: Clean and potable.

F. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Use only in combination with masonry units manufactured with integral water repellent admixture.
   2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
   3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: As indicated on the Drawings: uncoated finish.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells; minimum 0.148-inch steel wire, hot dipped galvanized after fabrication; provide for number of bars indicated on Drawings.

C. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Similar to Hohmann & Barnard, Inc. with Pencil Rod.
      a. At Frame Walls: HB-213 S.I.S. Seismic Veneer Anchor, galvanized, depth as required to span from face of sheathing at frame walls to center of veneer.
      b. At Structural CMU Walls: HB-5213, galvanized, depth as required to span from face of structural CMU to center of CMU veneer. Provide with HB-213 Washer to hold insulation to back up. Anchor to structural CMU with manufacturer recommended threaded stainless steel masonry anchor.
   2. Anchor plates: Not less than 0.105 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage. Provide anchor depth as required to center Pencil Rod within masonry mortar bed.
   3. Pencil Rod: 9 gage, galvanized as indicated above.
   4. Vertical adjustment: Not less than 3-1/2 inches.

D. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.05 FLASHINGS

A. Metal Flashing Materials:
   1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.

2.06 ACCESSORIES

A. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Advanced Building Products, Inc; Mortar Break DT: www.advancedbuildingproducts.com/#sle.
         2) Advanced Building Products Inc; Mortar Break: www.advancedbuildingproducts.com/#sle.
         3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
         4) CavClear, a Division of Archovations Inc; CavClear Masonry Mat: .
         5) Substitutions: See Section 01 6000 - Product Requirements.

B. Weeps: Cellular plastic. One piece, flexible extrusion made form UV- resistant polypropylene copolymer, full heights and width of head joint and depth 1/8 less than depth of out wythe, color selection from manufacturer's standard.
   1. Manufacturers:
      a. Advanced Building Products Inc; Product Mortar Maze weep vent.
      b. Hohmann & Barnard, Inc; Product Quadro-Vent: www.h-b.com.
      c. WIRE-BOND; Product Cell Vent #3601: www.wirebond.com.
      d. Mortar Net Solutions; Mortar Net CellVent: www.mortarnet.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials; approved by masonry manufacturer, compatible with water repellent specified in Section 07 1900.

2.07 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Loadbearing masonry: Type S (1800 psi).
   3. Non-loadbearing masonry: Type S (750 psi).

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Clean reinforcement of loose rust.

C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

D. Coordinate masonry work with installation of windows, doors, louvers, anchors, concrete slabs, and mechanical and electrical work.

E. For areas where high-lift grouting will be employed, provide cleanout openings as follows:
   1. Hollow Masonry: Not less than 8 inches high at the bottom of each cell to be grouted, formed by cutting out face shell of masonry unit.

3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.
   4. Mortar Joints:
      a. At exterior facing Gymnasim back-up walls to receive Weather Barrier: Flush.
      b. At all other conditions: Concave

3.04 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar and mortar smears as work progresses.

D. Interlock intersections and external corners, except for units laid in stack bond.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 WEEPS/CAVITY VENTS

A. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.06 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.07 REINFORCEMENT AND ANCHORAGE

A. Install reinforcement as indicated on Drawings.

B. Keep vertical cores to be grouted clear of mortar, including bed area of first course.
   1. Bond Beams: At bond beams or other locations for horizontally reinforced masonry, provide special masonry units or saw to accommodate reinforcement.

3.08 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

C. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.09 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
   2. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.
   3. Anchor vertical leg of flashing into backing with a termination bar and sealant.
   4. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

D. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

F. Thru-Wall Flashing
   1. Extend flashings through veneer, turn up minimum of 6 inches above top of concrete curb/base, and seal to exterior wall sheathing. Use flashing manufacturer's recommended adhesive and sealer.
   2. Lap weather barrier over vertical leg of flashing
   3. Lap thru-wall flashings over stainless steel flashing as shown on Drawings, to within 1/4 inch of exterior face of masonry.

3.10 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.
   1. Refer to General Structural Notes on the Drawings.

B. Place and consolidate grout fill without displacing reinforcing.

3.11 CONTROL AND EXPANSION JOINTS

A. Provide vertical control joints as shown on the Drawings.

B. Do not continue horizontal joint reinforcement through control or expansion joints except as otherwise indicated on the Drawings.

C. Form expansion joint as detailed on drawings.

D. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

3.12 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

3.13 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

A. Cut and fit for pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests and inspections, as specified in Section 01 4000 - Quality Requirements.

B. Inspections:

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.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.16 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.17 PROTECTION

A. Protection of Masonry: During construction, cover tops or walls, projections, and sills with waterproof sheeting at end of each workday. Cover partially completed masonry when construction is not in progress.

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.

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 comes 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, and similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near walls on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 04 2000

SECTION 04 2001

MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Clay facing brick.

C. Hollow brick.

D. Mortar.

E. Reinforcement and anchorage.

F. Flashings.

G. Installation of lintels.

H. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup

B. Section 04 2000 - Unit Masonry: Engineered Masonry

C. Section 05 4000 - Cold-Formed Metal Framing: Steel stud backup for masonry veneer.

D. Section 05 5000 - Metal Fabrications: Loose steel lintels.

E. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

F. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

B. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2018.

C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

D. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

F. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

H. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2005.

I. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

J. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2005.

K. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

L. Oregon Structural Specialty Code, Latest edition

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar.

C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.07 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.

B. Locate where directed.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
   1. Store off ground, on pallets, covered. Protect reinforcement from elements.

1.09 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602.

B. Protection of Work:
   1. During erection, cover top of wall with strong waterproof membrane at end of each day or shutdown.
   2. Cover partially completed walls when work is not in progress.

C. Stain Prevention:
   1. Prevent mortar from staining the face of masonry to be left exposed or painted. Remove immediately mortar in contact with face of such masonry. Protect all sills, ledges and projections from droppings of mortar, protect door jambs and corners from damage during construction.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY VENEER UNITS

A. Concrete Block Veneer: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 4" unless otherwise indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
      b. Exposed Faces: Special color and texture where indicated, as follows: Ground face masonry units.
      c. Color: As indicated on Exterior Color Schedule

B. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
   1. Performance of Units with Integral Water Repellent:
      a. Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
         1) No water visible on back of wall above flashing at the end of 24 hours.
         2) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
         3) No more than 25 percent of wall area above flashing visibly damp at end of test.
      b. Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.

c. Compressive Strength: ASTM C1314; maximum 5 percent decrease.
d. Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
2. Use only in combination with mortar that also has integral water repellent admixture.
3. Use water repellent admixtures for masonry units and mortar by a single manufacturer.
4. Manufacturers:
a. ACM Chemistries; RainBloc Water Repellent Masonry Unit Admixture.
b. BASF Aktiengesellschaft; Rheopel Plus.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Block Admixture.
d. Substitutions: See Section 01 6000 - Product Requirements.
5. Extent of Work: Provide units with integral water repellent:
a. Where finished surfaces will be exposed to weather.
b. At any below grade masonry.

C. Concrete Masonry Cap Blocks
1. Type: Solid Units
2. Manufacturing Standards: Equivalent to Concrete Block described above.
3. Units to have Ground Face and Edge matching appearance and color of Concrete Block as shown on drawings. Grey color unless otherwise noted.
4. Units to have Ground Edge matching appearance and color of Concrete Block as shown on drawings.
5. Nominal Sizes, unless otherwise shown on drawings:
a. CMU Solid Cap: Nominal dimensions of 2 inches tall x 8 inches deep x 16 inches wide.

2.02 BRICK UNITS

A. Manufacturers:
1. H.C. Muddox: https://www.hcmuddox.com/
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW, Modular.
1. Color and Texture: Old Town Red, wire cut.
2. Nominal Size: As indicated on drawings.
3. Compressive Strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

2.03 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
1. Color(s): A dark gray color selected by Architect from manufacturer's full range.
2. Manufacturers:
a. Davis Colors, a division of Venator Materials PLC: www.daviscolors.com/#sle.
b. Lambert Corporation: www.lambertusa.com/#sle.
c. Solomon Colors, Inc: www.solomoncolors.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

E. Water: Clean and potable.

F. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
1. Use only in combination with masonry units manufactured with integral water repellent admixture.
2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.

3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.04 REINFORCEMENT AND ANCHORAGE

A. Joint Reinforcement Type: As indicated on drawings.

B. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.
   4. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.

C. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.05 FLASHINGS

A. Combination Non-Asphaltic Flashing Materials - Stainless Steel:
   1. Stainless Steel Flashing - Self-adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner.
      a. Manufacturers:
         1) STS Coatings, Inc: www.stscoatings.com/#sle.
         2) VaproShield, LLC: www.vaproshield.com/#sle.
         3) York Manufacturing, Inc; York 304: www.yorkmfg.com/#sle.
         4) Substitutions: See Section 01 6000 - Product Requirements.

B. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
      b. WIRE-BOND: www.wirebond.com/#sle.
      c. York Manufacturing, Inc; Multi-Flash SS: www.yorkmfg.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M; 2 mil type 304stainless steel sheet bonded between one sheet of polymer fabric and one sheet of non-woven drainage material.
   1. Manufacturers:
      a. STS Coatings, Inc: www.stscoatings.com/#sle.
      b. York Manufacturing, Inc; Flash-Vent SS: www.yorkmfg.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Stainless Steel/Polymer Fabric Drainage Plane Flashing - Self-Adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner on one side and a sheet of non-woven drainage material bonded to the other side.
   1. Manufacturers:
      a. York Manufacturing, Inc: www.yorkmfg.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

E. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
      b. Mortar Net Solutions; CompleteFlash: www.mortarnet.com/#sle.
      c. York Manufacturing, Inc: www.yorkmfg.com/#sle.

F. Termination Bars: Stainless steel; compatible with membrane and adhesives.
   1. Manufacturers:

a. Mortar Net Solutions; Termination Bars: www.mortarnet.com/#sle.
b. York Manufacturing, Inc.: www.yorkmfg.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

G. Drip Edge: Stainless steel; compatible with membrane and adhesives.
1. Manufacturers:
a. Mortar Net Solutions; Metal Drip Edges: www.mortarnet.com/#sle.
b. York Manufacturing, Inc.: www.yorkmfg.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

H. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

I. Lap Sealant: Butyl type as specified in Section .

2.06 LINTELS

A. Steel lintels provided by Section 05 5000 - Metal Fabrication.

2.07 ACCESSORIES

A. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
1. Manufacturers:
a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
b. WIRE-BOND: www.wirebond.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

B. Weeps:
1. Type: Extruded propylene with honeycomb design.
2. Color(s): As indicated on drawings.
3. Manufacturers:
a. Advanced Building Products, Inc: www.advancedbuildingproducts.com/#sle.
b. Blok-Lok Limited: www.blok-lok.com/#sle.
c. CavClear/Archovations, Inc: www.cavclear.com/#sle.
d. Hohmann & Barnard, Inc: www.h-b.com/#sle.
e. Mortar Net Solutions; WeepVent: www.mortarnet.com/#sle.
f. WIRE-BOND: www.wirebond.com/#sle.
g. York Manufacturing, Inc.: www.yorkmfg.com/#sle.
h. Substitutions: See Section 01 6000 - Product Requirements.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1. Mortar Diverter: Panels installed at flashing locations.
a. Manufacturers:
1) Advanced Building Products, Inc: www.advancedbuildingproducts.com/#sle.
2) CavClear/Archovations, Inc: www.cavclear.com/#sle.
3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
4) York Manufacturing, Inc.: www.yorkmfg.com/#sle.
5) Substitutions: See Section 01 6000 - Product Requirements.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.08 MORTAR MIXING

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
1. Masonry below grade and in contact with earth; Type S.
2. Exterior, non-loadbearing masonry; Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running unless otherwise shown on drawings.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Brick Units:

3.03 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.

B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

C. Remove excess mortar as work progresses.

D. Interlock intersections and external corners, except for units laid in stack bond.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with compressible joint filler.

3.04 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.05 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.
   1. Verify that airspace width is no more than 3/8 inch greater than panel thickness.
   2. Hold cavity mortar control panel tight to face wythe.
   3. Install horizontally between joint reinforcement.
   4. Stagger end joints in adjacent rows.
   5. Fit to perimeter construction and penetrations without voids.

D. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.06 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: At spacing indicated on the Drawings, secure veneer anchors to structural masonry backup and embed into masonry veneer. Place additional anchors at perimeter of openings and ends of panels as indicated.

B. Stud Back-Up: Secure At spacing indicated on the Drawings, secure veneer anchors to stud framed back-up and embed into masonry veneer. Place additional anchors at perimeter of openings and ends of panels, as indicated.
   1. Refer to the Drawings for maximum vertical spacing of continuous horizontal seismic wire reinforcement.

C. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

D. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

3.07 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 8 inches, minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
   2. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.
   3. Anchor vertical leg of flashing into backing with a termination bar and sealant.
   4. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

D. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.08 LINTELS

A. Install loose steel lintels over openings where shown on drawings.

B. Maintain minimum 6 inch bearing on each side of opening, unless otherwise noted.

3.09 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install control joint filler material in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

D. Form expansion joint as detailed on drawings.

E. Joint Spacing: Locate control joints in unit masonry walls where shown on drawings unless otherwise noted.

3.10 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.11 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 04 2001

SECTION 05 1200

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members and struts.

C. Base plates, shear stud connectors and expansion joint plates.

D. Anchor bolts and setting templates for structural steel.

E. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 05 1213 - Architecturally-Exposed Structural Steel Framing: Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

B. Section 03 10 00 - Concrete Forms and Accessories: Placement of Anchor Bolts & Embeds.

C. Section 05 1215 – Buckling Restrained Braced Frames.

D. Section 05 2100 - Steel Joist Framing.

E. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

F. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges, American Institute of Steel Construction, Inc.; latest edition, Chapter 10 (Architecturally Exposed Structural Steel).

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.

F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).

G. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2020.

H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).

I. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.

J. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

N. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2014, with Errata (2015).

O. OSSC - Oregon Structural Specialty Code; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Structural steel shop drawings shall contain sufficient detail and information to allow complete fabrication and erection of the structure without reference to the contract drawings either on the fabrication shop floor or at the project site. The steel detailer shall generate all shop drawing fabrication and installation details from the structural and architectural drawings and specifications. The use of reproductions or photocopies of the contract drawings shall not be permitted.
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, fasteners, and finish.
   2. Connections
   3. Indicate cambers.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
   5. Indicate locations, critical dimensions, required clearances, construction details, installation methods including any splices, attachments and anchors. Show holes, threaded fasteners, and welds.
   6. Indicate which members are considered as Architecturally Exposed Structural Steel.
   7. Indicate sizes, dimensions and locations of structural thermal break plates, structural thermal break washers and bushings.
   8. Indicate members to be galvanized, location and size of drain holes, and which members are to receive field finish painting that may impact the galvanizing process.
   9. Indicate portions of members not to be painted due to member receiving fire proofing, in contact with concrete, or connected with tension-controlled slip critical-bolts.
   10. Shop drawing re-submittals shall clearly identify all revisions to previous submittals.
      a. Heavy ink clouded outlines (revision clouds) shall be drawn around revised areas of individual sheets.
      b. Architect/Engineer will not review information outside of revision clouds on resubmitted drawings.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer’s Certification: Certify that structural thermal break materials comply with specified requirements and are suitable for intended application.

E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is an AISC-Certified Plant, Category BU, or is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
   1. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section 05 1213.

B. Fabricator: Company specializing in performing the work of this section with minimum five years of successful documented experience.

C. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating Architecturally Exposed Steel (AESS) similar to that indicated on this Project.

1.06 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 support spacers. Protect steel members and packaged materials from erosion and deterioration.
   1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
3. Store welding electrodes as specified by AWS.

PART 2 PRODUCTS

2.01 MATERIALS

A. Recycled Content: Steel W, T, HSS, Pipe, Angles, Plates, Channels, and Bars are to meet or exceed the industry standards for recycled content for the electric arc furnace process. Post-consumer content of 56%, Pre-consumer content of 32%. See the current edition of Steel Recycling Institute "Steel Takes LEED with Recycled Content; http://www.recycle-steel.org/en/Recycling%20Resources/~/media/Files/SRI/Media%20Center/LEED_Sept2011.pdf.

B. Steel Angles, Plates, Channels, and Bars: As indicated on the Drawings.

C. Steel W Shapes and Tees: As indicated on the Drawings.

D. Cold-Formed Structural Tubing and Hollow Structural Sections: As indicated on the Drawings.

E. Pipe: As indicated on the Drawings.

F. Structural Bolts and Nuts: As indicated on the Drawings.

G. High-Strength Structural Bolts, Nuts, and Washers: As indicated on the Drawings.

H. Load Indicator Washers: ASTM F959

I. Threaded Rods: As indicated on the Drawings.

J. Unheaded Anchor Rods and Bolts: ASTM F1554, Grade 36, plain, heavy hex head, with matching ASTM A563 or A 563M nuts and ASTM F436 Type 1 washers, unless otherwise noted.

K. Threaded Studs: Fusion welded, Nelson CPL type, size as noted on Drawings, length as required for full engagement of nut with washer. Stainless steel 18-8 threaded studs where noted on Drawings for connection to stainless steel material.

L. Welding Materials: AWS D1.1; type required for materials and conditions being welded.
   1. E70 Low Hydrogen Electrodes.

M. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
   3. Products:
      a. "Euco N.S." manufactured by Euclid Chemical Co.
      b. "Crystex" manufactured by L&M Construction Chemicals.
      c. "Masterflow 713" by Master Builders

N. Shop and Touch-Up Primer: Fabricator's standard, complying with project's VOC limitations.

O. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with project's VOC limitations.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible. Mark and match-mark materials for field assembly.

B. Fabricate connections for bolt, nut, and washer connectors.

C. Develop required camber for members as indicated on the Drawings.

D. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Base-Plate 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.

E. Re-Entrant Corners: Provide 1/2-inch radius at all re-entrant corners, unless noted otherwise.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP1,2 or 3, as required for application.

B. Shop prime structural steel members except the following:
1. Surfaces both located within the conditioned building envelope and concealed from view.
2. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
3. Surfaces to be field welded.
4. Surfaces of high-strength bolted, slip-critical connections.
5. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
6. Galvanized surfaces, unless indicated to be painted.

C. Hot-Dip Galvanizing: Galvanize all structural steel surfaces exposed to weather or located outside exterior wall framing. Also galvanize all steel lintels and shelf angles located in exterior walls, or embedded in concrete.
1. Steel members and fabrications: ASTM A 123.
2. Iron and Steel Hardware: ASTM A 153.

D. Hot-Dip Galvanizing and Finish Painting: Provide on structural steel surfaces outside of the conditioned building envelope and exposed to view, and where indicated on the Drawings; prepare galvanized surfaces per ASTM D6386.
1. Refer to Section 05 1213 – Architecturally Exposed Structural Steel Framing for those elements designated as AESS.

E. Below Grade Coating: Apply heavy coat of Kopper's Bitumastic No. 505 to that portion of column, base plate, and anchor bolts below grade where not protected by minimum 3" of concrete cover on all sides.

F. Structural Steel Primer: Comply with Section 09 9113 – Exterior Painting and Section 09 9123 – Interior Painting.

2.04 SHOP CONNECTIONS

A. Shop install and tighten non-high-strength bolts, except where high-strength bolts are indicated.

B. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
1. Bolts: ASTM A 325 high-strength bolts, unless otherwise indicated on the Drawings.
2. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.

C. Welded Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Refer to Section 05 1213 – Architecturally Exposed Structural Steel Framing for those elements designated as AESS.

2.05 ACCESSORIES

A. Structural Thermal Breaks: Provide structural thermal breaks capable of withstanding and/or transferring the design loads where and as indicated on the Drawings.
1. Manufacturers:
a. Fabreeka-TIM by Fabreeka International, Inc.: www.fabreeka.com.
b. Armatherm FRR by Armatherm: www.armatherm.com.
c. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing to perform shop inspections and tests and to prepare test reports in accordance with IBC Chapter 17 and the Structural Drawings.
   1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirement.
   2. Provide testing agency with access to places where structural steel work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

B. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

C. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
   1. Temporary Shoring and Bracing: Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
   2. Temporary Welded Connections: Remove at main structural members by chipping or other procedure approved by the Architect. Burning will not be permitted at the welded connections.
   3. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

C. Remedial Work: Correct errors in shop fabrication or deformation resulting from handling or transportation that prevent proper assembly and fitting of parts by methods meeting the approval of the Architect and at no additional cost to the Owner.

D. Erection Equipment: Provide erection equipment suitable and safe for workmen and capable of accommodating construction requirements of this project.

E. Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete bearing surfaces and locations of anchor bolts and similar devices before erection work proceeds and report discrepancies to Architect. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with Architect.

F. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Furnish steel templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

G. Field Assembly.
   1. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assemble. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

2. Drift pins shall only be used to bring together the several parts. They shall not be used in such a manner as to distort or damage the metal.
3. Level and plumb individual members of structure within specified AISC tolerances.
4. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
5. Splice members only where indicated.
6. On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.
7. Comply with AISC specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
8. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
9. Refer to Section 05 1213 – Architecturally Exposed Structural Steel Framing for those elements designated as AESS.

H. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted

I. Erection Loading: The structural design of the building is based on resistance to dead loads, code specified lateral loads, and maximum expected service loads. No consideration has been given to loads which will be induced by erection procedures. The Contractor shall verify, to their own satisfaction and to that of the Owner, the ability of the structure to resist all erection loads without exceeding the allowable stresses of the materials used. Where erection loads would overstress the structure, special temporary bracing and strengthening shall be utilized to prevent such overstress during erection.

J. Field weld components as indicated on shop drawings.

K. Bolted Connections.
1. Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified on the Drawings.
2. Refer to Section 05 1213 – Architecturally Exposed Structural Steel Framing for those elements designated as AESS.

L. Welded Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Remove all paint or galvanizing from areas receiving field welding prior to proceeding.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Remove backing bars or runoff tabs, back gouge, and grind steel smooth where indicted.
4. Refer to Section 05 1213 – Architecturally Exposed Structural Steel Framing for those elements designated as AESS.

M. Shear Connector Studs: Automatically end-weld in field in accordance with manufacturer's recommendations.

N. Do not field cut or alter structural members without approval of Architect and Structural Engineer.

O. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
1. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

P. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

Q. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. Owner will engage an independent testing and inspection agency to perform inspections and tests as indicated in the Drawings.

B. The Contractor shall provide verification of steel elevations prior to installation of concrete. At a minimum, measure elevations at all columns and at mid-span of all beams. Notify Architect if any steel elevations are out of tolerance prior to placement of concrete.

C. Defective Welds: All welds found defective and repaired shall be re-inspected by the same methods originally used and this re-inspection shall be paid for by the Contractor.

D. Access to Field.

1. The contractor shall cooperate in giving advance notice of their operations and shall provide access to the work. Inspection in shop or field shall not relieve the Contractor of their responsibility to furnish satisfactory products. The acceptance of material or finished members by the inspector shall not prevent subsequent rejection if found defective either because of inferior materials or inferior workmanship. Inferior material or workmanship will be subject to rejection unless correction acceptable to the Architect can be made prior to final acceptance of the structure and at no extra cost to the Owner.
2. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be in noncompliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm and noncompliance of original work and as may be necessary to show compliance or corrected work.

E. Correct deficiencies in Work that test reports and inspections indicated does not comply with the Contract Documents.

F. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

END OF SECTION 05 1200

SECTION 05 1213

ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this section.

B. Section 05 3100 - Steel Decking: Erection requirements relating to exposed steel decking and its connections.

C. Section 05 5000 - Metal Fabrications: Steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.

D. Section 09 9113 - Exterior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

E. Section 09 9123 - Interior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

F. Section 09 9600 - High-Performance Coatings: Finish coat requirements and coordination with primer and surface preparation specified in this section.

1.03 DEFINITIONS

A. Architecturally-Exposed Structural Steel: Structural steel complying with designated AESS category as defined in AISC 303.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

B. AISC 360 - Specification for Structural Steel Buildings; 2016.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2019.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.

F. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS); 2015.

G. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

J. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

K. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting at project site one week prior to start of work of this section; require attendance by all affected installers. Coordinate requirements for shipping, special handling, storage, attachment of safety cables and temporary

erection bracing, final coating, touch-up painting, mock-up coordination, Architect's observations, and other requirements for AESS.

1.06 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product data for each type of product specified. Submit paint systems in accordance with Section 09 9600.

C. Shop Drawings: Detailing for fabrication of AESS components. Shop drawings for structural steel may be used for AESS.
   1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
   2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.
   3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.
   4. Indicate orientation of hollow structural section (HSS) seams and mill marks (where applicable).
   5. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections. Indicate orientation of bolt heads.
   6. Indicate which surfaces or edges are exposed and what class of surface preparation is being used.
   7. Indicate special tolerances and erection requirements as noted on drawings or defined by the designated AESS category.
   8. Indicate vent or drainage holes for HSS members.
   9. Indicate surface preparation, primer and coating requirements, including systems specified in other Sections.

D. Qualification data for fabricator and erector to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, and other information specified.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Section 05 1200, engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the work.

B. Erector Qualifications: In addition to those qualifications listed in Section 05 1200, engage an AISC Certified Erector, experienced in erecting AESS work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

C. Comply with applicable provisions of AISC 303, Section 10 for the designated AESS category.

1.08 FABRICATION - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL (AESS)

A. Architecturally Exposed Structural Steel is defined as those steel surfaces and connections which will remain exposed on the following project elements:
   1. Covered Play Structure
   2. Interior stair and railing assemblies
   3. Exposed steel columns and roof framing
   4. Supporting steel at aluminum storefronts at the following locations:
      a. Stair A100
      b. Vestibule B100
      c. Entry Commons B101
      d. Commons C100
      e. Commons C102
   5. Exterior steel scuppers and downspouts

6. Exterior canopies and structure
7. Exterior bicycle parking structure
8. Other items as indicated on Drawings.

1.09 MOCK-UP

A. Provide mock-ups for AESS 1 and AESS 2 of nature and extent indicated in Contract Documents.

B. See Section 01 4000 - Quality Requirements for additional requirements.

C. Locate mock-ups in fabricator's shop. Mock-ups to be full-size unless Architect approves smaller models. Alternatively, when a mock-up is not practical, the first piece of an element or connection can be used to determine acceptability.

D. Notify Architect one week in advance of dates and times when mock-ups will be available for review.

E. Demonstrate applicable AESS characteristics for specified category of AESS on elements and joints in mock-up.

F. Build mock-ups using member sizes and materials indicated for final work.

G. Mock-up to demonstrate weld quality, contouring of welds at aligned walls of members, specified surface preparation, and finish coating.

H. HSS members to extend at least 6 inches from joint in mock-up.

I. Obtain Architect's written approval of mock-ups before starting fabrication.

J. Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging completed work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

1.11 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Comply with Section 05 1200, except as amended in this section for aesthetic purposes.

B. Comply with Section 05 5000, except as amended in this section for aesthetic purposes.

C. Comply with AISC 303, Section 10 for specific AESS category designated on drawings.

2.02 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Bolted Connections:
1. Make in accordance with Section 05 1200. Provide bolt type and finish as noted herein.

E. Welded Connections:
   1. Comply with AWS D1.1/D1.1M and Section 05 1200.
   2. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerances of this section.

F. Surface Preparation:
   1. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
   2. Remove backing and run out tabs.

G. Fabricate AESS in accordance with categories defined in AISC 303, as noted on the Drawings and as listed under Fabrication.

2.03 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Section 09 9600. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

B. Primer: As specified in Section 09 9113, 09 9123, and 09 9600. Primer to comply with all federal standards for VOC, lead and chromate levels.

C. Finish Coating: Field apply intermediate and top coats per Section 09 9113, 09 9123, and 09 9600.

2.04 SHOP PRIMING

A. Surface Preparation:
   1. Provide surface preparations to meet SSPC-SP 6.
   2. Coordinate required surface profile with approved paint submittal prior to beginning surface preparation.
   3. Prior to blasting, remove any grease and oil using solvent cleaning to meet SSPC-SP 1.
   4. Remove weld spatter, slivers and similar surface discontinuities.
   5. Ease sharp corners resulting from shearing, flame cutting or grinding.

B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, or high strength bolted with slip-critical connections.
   1. Extend priming of members partially embedded in concrete or mortar to a depth of 2 inches.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

2.05 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by hot-dip process to AESS indicated for galvanizing according to ASTM A123/A123M. Fabricate such that all connections of assemblies are made in the field with bolted connections where possible.

2.06 MATERIALS

A. General: Meet requirements of 05 1200 as amended below.

B. Tension Control, High-Strength Bolts, Nuts, and Washers: Per section 05 1200, Tension Control Bolts. Provide standard carbon steel finish rounded bolt heads with twist off bolts; ASTM F3125/F3125M.

2.07 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify, with 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 bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.

B. Examine all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with fabricator prior to erecting steel.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.

B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.03 ERECTION

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Structural Requirements:
   1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 05 1200 for additional requirements.
   2. Quality assurance agency to review work for compliance with requirements of AISC 360, Chapter N and AISC 303, Section 10.

3.05 CLEANING

A. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 09 9113, 09 9123, and 09 9600.

B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION 05 1213

SECTION 05 1215

BUCKLING RESTRAINED BRACES

PART 1 GENERAL

1.01 SUMMARY

A. Provide all parts, materials, and labor required for the design, delivery, testing and erection of buckling-restrained braces, which are designed by the manufacturer to meet stiffness, yield strength, and elongation requirements as indicated on the Drawings and other requirements specified Herein. Section Includes:
   1. Furnishing buckling restrained braces as shown on Drawings.
   2. Engineering design of buckling restrained braces to meet the strength and deformation requirements specified on the Drawings and by this Section.
   3. Preparation of a Previous Test Results Report.
   4. Performance of uniaxial and subassemblage tests where a Previous Test Results Report cannot be furnished.

B. Scope: Within base contract price, allow for the design and furnishing of buckling restrained braces, preparation of a Previous Test Results Report including performance of uniaxial and subassemblage tests which will meet the loads and deformation requirements of this project.

C. Related Sections and Documents:
   1. The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.
   2. Division 5 Section "Structural Steel."

1.02 REFERENCES

A. Standards listed below apply where designation is cited in this Section. Where the applicable year of adoption or revision is not listed below, the latest edition applies.

B. ASTM - American Society for Testing and Materials:
   1. A6 - Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.
   2. A36 - Specification for Steel.
   3. A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   4. A490 - Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
   5. A500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing.
   6. A563 - Specification for Carbon and Alloy Steel Nuts.
   7. A572 - Specification for High Strength Low Alloy Columbium-Vanadium Steel of Structural Quality.
   8. A1085 – Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
   9. F844 - Specification for Washers, Steel, Plain (Flat) Unhardened for General Use.

C. AISC - American Institute of Steel Construction:
   1. Code of Standard Practice for Steel Buildings and Bridges, Latest Edition.
      a. The General Conditions, Supplementary Conditions and Division 1 shall govern in the case of conflicts with provisions of the Code.
   2. 2010 Seismic Provisions for Structural Steel Buildings (ANSI/AISC 341-10).

D. AWS - American Welding Society:
   1. D1.1 - Structural Welding Code, 2000 Edition.
   2. 353 - Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications.

E. RCSC Research Council on Structural Connections:
   1. Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2000 Edition.

F. SSPC - Steel Structures Painting Council's, "Systems and Specifications":
   1. SP1 - Solvent Cleaning.
   2. SP2 - Hand Tool Cleaning.
   3. SP3 - Power Tool Cleaning.
   4. SP6 - Commercial Blast Cleaning.

G. Leadership in Energy and Environmental Design (LEED).

1.03 DEFINITIONS

A. Brace Test Specimen: A single buckling-restrained brace element used for laboratory testing intended to model the brace in the Prototype.

B. Buckling Restrained Brace: Specialty structural bracing element consisting of a yielding steel core and a system of restraints that precludes buckling of the steel core at forces and inelastic deformations corresponding to the requirements of AISC Seismic.

C. Buckling-restraining System: A system of restraints which resists buckling of the steel core in buckling restrained braces. This system includes the casing on the steel core and structural elements adjoining its connections.

D. Casing: An element that resists forces transverse to the axis of the buckling restrained brace.

E. Heavy Plates: Plates used in the Steel Core that are 2 inches thick or thicker.

F. Previous test Results Report: A report that documents the buckling restrained brace manufacturer's compliance with the requirements specified on the Drawings and in this Section.

G. Prototype: The brace, connections, members, steel properties, and other design, detailing, and construction features to be used in the actual building frame.

H. Seismic Critical Weld (SCW): Welds used to manufacture the steel core.

I. Steel Core: The axial-force-resisting element of buckling restrained braces.

J. Sub-assemblage Test Specimen: The combination of the brace, the connections and testing apparatus that replicate as closely as practical the axial and flexural deformations of the brace in the Prototype.

1.04 SUBMITTALS

A. Submit the following in accordance with Division 1 Section "Submittal Procedures."

B. Prior to bid, furnish schedule for submittal of Previous Test Results Report, performance of specimen tests if required, and manufacture and delivery of buckling restrained braces.

C. Previous Test Results Report.

D. Manufacturer's Quality Assurance Plan.

E. Proposed Design of Buckling-Restrained Braces: Design Drawings shall clearly display size, thickness and length of exterior brace casing as well as configuration and size of the full length of the core plates. Calculations shall be provided to display the ability of the proposed "BRB's" to meet the Performance Criteria described herein. The Design Drawings and Calculations shall be sealed and stamped by a Structural/Professional Engineer (S/P.E.) licensed in the State of Oregon.

F. Shop Drawings:
   1. Provisions of Article 4.4 of AISC Code pertaining to time for review are superseded by provisions of Division 1 Section "Submittal Procedures."
   2. Shop drawings shall clearly display all geometries necessary to manufacture BRB's including plate thickness, lengths, plate dimensions inside and outside of the casing, and casing dimensions. Shop drawings shall clearly display all connection information including location of bolts, bolt types, bolt diameters, hole size, and faying surface types.
   3. Indicate welded connections using standard AWS symbols.
   4. Shop drawings shall clearly display all geometries necessary to manufacture BRB's including plate thickness, lengths, plate dimensions inside and outside of the casing, and casing dimensions

5. Shop drawings shall clearly display all connection information including location of bolts, bolt types, bolt diameters, hole size, and faying surface types.

G. Material Test Reports
   1. Tensile tests and chemical analysis for all steel.
   2. Independent coupon tests used to verify core plate initial yield stress, tensile stress, and ultimate elongation.
      a. Where core plates are fabricated from plate material, coupon tests shall be performed on each plate.
      b. Where core plates are fabricated from bar stock, coupons shall be made at intervals of each 5 tons of material of same heat and thickness.
      c. Coupon tests to be taken at point of manufacture. Mill test reports (MTR) may not be used.
   3. Plates 2 inches (50mm) and thicker shall be supplied with Charpy V-Notch testing in accordance with ASTM A673, Frequency P, or approved equal. The impact test shall meet a minimum average value of 20 ft-lbs absorbed energy at +70 degrees Fahrenheit and shall be conducted in accordance with AISC Specification, or approved equal.

H. Technical Report
   1. The Manufacturer shall submit a BRB testing report. The testing configurations used, and the results obtained shall meet the criteria found in the AISC 2010 Seismic Provisions (341-10).

I. Welding Certificates
   1. Welder Performance Qualification Records (WPQR's)
   2. Welding Procedure Specification (WPS) written in conformance with AWS D1.1 for each proposed type of welded joint, whether pre-qualified or qualified by testing.

J. Manufacturer's Quality Assurance Plan

K. Manufacturer's in-house Quality Assurance Inspection Report for each brace upon completion of fabrication.
   1. Outside Testing Agency Quality Control Report where applicable.

1.05 REDESIGN AND RETESTING

A. Contractor shall obligate Buckling Restrained Brace Manufacturer to provide buckling restrained braces that conform to the requirements of this Specification. Should prototype and specimen braces as designed and fabricated by Manufacturer not conform to the project requirements, Buckling Restrained Braces shall be redesigned and retested until requirements of this Specification are satisfied at no additional cost to the owner. Any cost of redesign by the engineer of record due to the different brace or the connections shall be paid by the manufacturer requesting the changes.

1.06 QUALITY ASSURANCE

A. Quality Assurance Plan: Contractor shall provide a detailed Quality Assurance plan prior to manufacturing production braces. The Quality Assurance plan shall include descriptions of manufacturing procedures, quality control testing program for materials, and all points of internal inspection and sign-off for control and monitoring of the fabrication and assembly process. Plan will include Quality Control for erection, including attendance at mandatory pre-erection conference and observation of initial installed braces.

B. Design Engineer Qualifications: A Professional Engineer, registered in the State of Oregon that is knowledgeable with the results of cyclic testing of BRB's and the requirements of this specification and experienced in the design of BRB's based on engineering analysis shall approve and stamp all drawings.

C. Pre-Erection Conference: Contractor shall schedule meeting with the Owner, Architect, buckling restrained brace Manufacturer, and the Steel Erector's personnel supervising installation of buckling restrained braces to review installation procedures including handling, fit-up and fastening.

D. Coupon Tests: Perform coupon test results for each lot of steel used in fabrication of steel core areas showing initial yield, ultimate tensile stress, and ultimate elongation. Coupons shall be taken from plates at point of brace manufacture and shall be used as the basis for brace design

E. Contractor shall obligate Manufacturer's Representative to visit the site to observe initial installation of buckling restrained braces in accordance with Quality Assurance Plan.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plants fabricating buckling-restrained braces shall comply with the following:
   1. Obtain and maintain accreditation from The American Institute of Steel Construction (AISC Certified Fabricator) in conjunction with any additional certifications required by the local jurisdiction.
   2. Have a minimum of 5 years of documented continuous experience in the fabrication of buckling-restrained braces with a minimum of 30 completed projects over this same period.
   3. Buckling-restrained braces for this project shall be manufactured in the same facility (following the same quality assurance procedures) as the braces manufactured and tested to fulfill the AISC 341 testing requirements.

B. Buckling-Restrained Braces shall be manufactured and supplied by the following vendor or equal.
   1. CoreBrace, LLC; www.corebrace.com.
   2. Nippon Steel; www.eng.nipponsteel.com/english.

C. Documentation showing evidence of valid accreditation and experience shall be submitted to the Engineer of Record during the bidding phase for any proposed manufacturer not listed above

D. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.02 MATERIALS

A. Steel Core and Core Projection: ASTM A36 with Fy as noted on the drawings.
   1. Fy of all core plate material shall be verified via coupon test per Article 1.04.G.2.
   2. Core plates 2 inches (50mm) and thicker shall be supplied with Charpy V-Notch testing per Article 1.04.G.3.
   3. If not noted on the drawings, use 38ksi = Fy = 46ksi.

B. Casing:
   1. ASTM A500, Gr. B or similar for square or rectangular sections.
   2. ASTM A500, Gr. B or A53, Gr. B or similar for round sections.

C. Welding Materials: Filler material shall possess a minimum Charpy V-notch toughness of 20 ft-lbs at minus 20 deg F.

D. Shop Primer: Manufacturer's standard.

E. Debonding Agent: Manufacturer's standard; able to maintain separation of steel core and 'grout encasement when subjected to the loading protocol per AISC Seismic; resistant to aging effects for a life cycle of 25 years.

F. Fill Material: Manufacturer's standard cementitious grout; demonstrated suitable for function by prototype testing shown by test results to perform acceptably as a confining in-fill material.

2.03 DESIGN REQUIREMENTS

A. A Structural Engineer shall design the buckling-restrained braces to meet the Performance Requirements. The Structural Engineer shall have a thorough knowledge of the qualifying cyclical tests and competently apply the test results to the Project conditions.

B. Interpolation or extrapolation of test results for different member sizes shall be justified by rational analysis that demonstrates stress distributions and magnitudes of internal strains that

are consistent with or less severe than the tested assemblies and that considers the adverse effects of larger material and variations in material properties.

C. Stability calculations shall include beams, columns and gussets adjoining the BRB's.

D. End rotation effects corresponding to the larger of 2.0 times Design Story Drift or .025 radians minimum shall be considered.

E. Where bracing connections are designed by manufacturer, they shall be designed to a minimum of 1.1 times the adjusted brace strength as defined in Article 2.04.F. Connection design shall include length effects for long BRBs as described in Article 2.03.F.

F. Buckling-restrained braces longer than 35 feet (or greater than 200% of the qualifying test specimen) shall account for length effects in the determination of the compression overstrength factor (b). BRB manufacturer shall submit design methodology to justify values used to determine length effects. This methodology must include the comparison of test results of at least (2) long BRBs (minimum of 40 feet long) to a control sample of one-half the length of the long specimen. Both the control sample and the long specimen shall be of similar capacity (±5%) for comparison.

2.04 PERFORMANCE REQUIREMENTS

A. Core plate material shall have a yield range of 42 ksi within ±4 ksi unless indicated otherwise in the structural BRB drawings. Coupon tests taken from plates at point of manufacture of BRBs shall be used to verify conformance. Additional coupon tests may be performed to replace coupon tests that fall out of acceptable range.

B. Increasing amplitude cyclic displacement tests per the AISC Seismic Provisions shall provide stable performance up to a displacement corresponding to 2.0 x Design Story Drift.
   1. Hysteretic behavior shall display no post-yield loss of strength, degradation, or pinching.
   2. Fracture of any portion of the BRB shall not occur during the qualifying tests.
   3. The cumulative ductility factor requirement specified in AISC 341 shall be increased from 200 to 300.

C. The steel core shall resist compression and tension forces. The steel core area shall be as per the project drawings and based on the yield stress range specified.

D. The steel and concrete casing shall prevent the steel core from buckling globally and locally during compressive loading without binding due to longitudinal shortening and transverse expansion. Demand for local and global stability of casing checks shall be based on the adjusted brace strength at the maximum yield stress (Fysc,max) of the specified yield stress range of the core plate material. Casing design shall include length effects for long BRBs as described in Article 2.03.F.

E. Steel core projections beyond the steel casing and brace connections shall develop the adjusted brace strength without instigation of fracture or instability. For core plate checks use the minimum (Fysc,min) of the specified yield stress range for determining demand. For all other materials use Fysc,max to determine demand.

F. The overstrength factors (w, b) shall be determined at a brace strain level associated with the greater of a 2% interstory drift or twice the design story drift, the latter of which is taken as (2fCdFysc,min)/(?IeE). Where Pd is provided, twice the design story drift is taken as (2CdPd)/(Asc?IeE). Cd is the design drift deflection amplification factor, E is the nominal modulus of elasticity of the core plate material, Ie is the Importance Factor, r is the Redundancy Factor, and Pd is the demand in the BRBs at the controlling drift design load case with gravity loads excluded. Compression overstrength determination shall include the effects of brace length as described in Article 2.03.F.

2.05 QUALIFICATION TESTS

A. Buckling-restrained brace design shall be based on two qualifying cyclic tests conforming to the AISC Seismic Provisions for Buckling Restrained Braced Frames. As stated in the Provisions, at least one of the two qualifying tests needs to be a subassemblage test to demonstrate the ability of the BRB to withstand rotational demands. The other test may be performed uniaxially or may also be a subassemblage test.

B. The requirements of the AISC 341 Seismic Provisions shall be met along with the modification in Article 2.04.B.3.

C. The strain level during testing shall be equivalent to, or greater than, the strains that the project braces will be expected to withstand.

D. Qualifying cyclical tests can be based on full-scale cyclical tests previously reported for projects, or research that are deemed similar to project conditions by the Manufacturer and Project Engineer.

E. Qualification testing of long braces, if BRBs on this project are of sufficient length, as required in Article 2.03.F

2.06 FABRICATION

A. Braces shall be fabricated in accordance with AISC Code of Standard Practice and in an AISC Certified Shop that participates in the AISC Quality Certification Program.

B. Core plates shall be cut to profile shown on Design Drawings.
   1. The general roughness cannot exceed 1000 micro-inches in the yielding length.
   2. Notches in yield length region up to 1/8–inch may be repaired by grinding to a smooth transition. The length of the transition shall not be less than 10 times the notch depth.
   3. Notches in the yielding length region greater than 1/8–inch and less than or equal to 3/8–inch may be repaired using procedures outlined in the Company Quality Assurance Manual. The repairs shall be examined using Ultrasonic Testing (UT) procedures in conformance with AWS D1.1.
   4. Notches in the yielding length region greater than 3/8–inch in the yield length shall be rejected.

C. No splices are allowed in the yielding region of the steel core plate.

D. Minimum casing dimensions shall be as required by manufacturer or as specified on the project documents.

E. Holes for bolted connections may be drilled, cut or punched in conformance with AISC standards and burs removed.

F. Finish shall be manufacturer's standard shop primer. Do not paint connection faying surfaces if connection are designated slip critical unless paint used provides same slip resistance

G. Assembly of the different components of the brace shall be done in accordance with the manufacturer's Quality Assurance Manual in a manner that ensures proper performance of the brace.

H. Pin-connection hole tolerance shall be +1/32", -0"

2.07 FINISH

A. Unprotected metal surfaces shall be prepared and painted to provide corrosion protection during transport.

2.08 SOURCE QUALITY CONTROL

A. Manufacturer's Quality Control: Perform testing and inspection in accordance with approved Quality Assurance Plan.
   1. Coupon Tests: Manufacturer shall test coupons from each lot of steel used in fabrication of buckling restrained brace core for initial yield, ultimate tensile stress, and ultimate elongation.

B. Notify the Engineer no less than 10 days before the start of fabrication of the buckling restrained braces, to allow the Engineer to observe fabrication and assembly process.

PART 3 EXECUTION

3.01 SHIPPING

A. Manufacturer to package BRB's for protection against shipping damage.

B. Manufacturer shall coordinate delivery dates and quantities with Contractor/Owner. Contractor/Owner shall provide adequate storage space and proper lay-down areas.

C. Braces shall be stored on dunnage not touching the ground.

D. Coordinate erection aid requirements with contractor/Owner.

3.02 EXAMINATION

A. Examine construction to receive braces to verify that conditions are proper.

B. Verify that surfaces to receive braces are clean.

C. Do not proceed with erection until unsatisfactory conditions are corrected.

3.03 ERECTION

A. Braces are to be erected under the Structural Steel Specification Section and according to referenced AISC Specifications.

B. Prior to erection, clean faying surfaces of BRB to be in contact with bolted connections to remove temporary coatings applied for transport and surface contaminants.

C. Manufacturer shall coordinate with Owner's Representative to verify proper BRB dimensions.

D. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of buckling-restrained braces.

E. No field welding to BRB's is allowed, including non-structural pieces unless approved by manufacturer and Engineer of Record (EOR).

F. No field cutting or altering is permitted without the approval of the manufacturer and EOR

END OF SECTION 05 1215

SECTION 05 2100

STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for floor and roof openings greater than 18 inches.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Superstructure framing.

B. Section 05 3100 - Steel Decking: Support framing for openings less than 18 inches in decking.

C. Section 05 5000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

A. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014 (Amended 2015).

B. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.

C. OSSC - Oregon Structural Specialty Code; latest edition.

D. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Qualification Data: For manufacturer.

C. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, attachments, and any reinforcement required for special or concentrated loads on the joists.

1. For each joist designation, indicate dimensions of chord members, web members, and distance between bearing plate and top of joist.
2. Indicate locations and sizes of additional web reinforcements or stiffeners required.
3. Indicate locations and details of bearing plates to be embedded in other construction.
4. As directed by Authority Having Jurisdiction, stamp and sign shop drawings by same professional structural engineer in responsible charge of Design Calculations.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

E. Design Calculations: Concurrent with the submittal of Shop Drawings, provide structural calculations bearing the stamp of a Professional Structural Engineer experienced in design of this work and licensed in the State of Oregon.

F. Allow time in the joist submittal review process for the general contractor to coordinate final rooftop equipment product data, submittals, and approvals in order to confirm equipment weight and dimensions.

1.05 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Oregon.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

C. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

D. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Erector Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products in accordance with SJI requirements.

1.07 SEQUENCING

A. Deliver steel bearing plates to be built into masonry and concrete construction.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide joists and connections capable of withstanding design loads indicated on Drawings within deflection limits indicated on Drawings.

2.02 STEEL JOISTS

A. Long-Span Steel Joist: Manufactured steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on the Structural Drawings.
   1. Frame special sized openings in joist web framing as indicated on the Structural Drawings.
   2. Provide holes in chord members for connecting and securing other construction to joists.
   3. Camber long-span steel joists according to SJI's "Specifications."
   4. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.03 PRIMERS

A. Primer:
   1. Provide shop primer that complies with Section 09 9123 "Interior Painting."

2.04 ACCESSORIES

A. Bridging:
   1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
      a. Coordinate locations of bridging with mechanical, electrical and/or plumbing distribution requirements.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings. Shop prime paint.

C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.
   1. Finish: Plain, uncoated.

D. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
   1. Finish: Plain.

E. Welding Electrodes: Comply with AWS standards.

F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.05 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Shop priming of joists and joist accessories is specified in Section 09 9000 "Painting and Coating."

2.06 SOURCE QUALITY CONTROL

A. At completion of fabrication, joist manufacturer shall submit a certificate of compliance in accordance with OSSC 1704.

B.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications joist manufacturer's written instructions, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.03 REPAIRS

A. Touchup Painting: Where steel joist framing is to receive finish painting.
   1. Cleaning and touchup painting are specified in Section 09 9000 "Painting and Coating."

3.04 FIELD QUALITY CONTROL

A. Testing and Inspection Agency: Owner will engage a qualified testing and inspection agency to perform tests and inspections as indicated on the Drawings.

END OF SECTION 05 2100

SECTION 05 3100
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustical cellular roof deck.
B. Roof deck.
C. Composite floor deck.
D. Supplementary framing for openings up to and including 18 inches.
E. Stud shear connectors.
F. Cold-formed accessories including closures and blocking.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.
B. Section 03 3000 - Cast-in-Place Concrete: Concrete topping over metal deck.
C. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 18 inches, shear stud connectors, and placement of embedded steel anchors for bearing plates in cast-in-place concrete.
D. Section 05 2100 - Steel Joist Framing: Support framing for openings larger than 18 inches.
E. Section 05 5000 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2018.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.
E. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2018.
F. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
C. Product Data: Provide deck profile characteristics, dimensions, structural properties, finishes, and acoustical properties.
D. Certificates: Certify that products furnished meet or exceed specified requirements.
E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
B. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:
   1. ASC Pacific.
   2. Epic Metals Corporation.
   3. IMSA.
   4. Verco.
   5. Nucor-Vulcraft Group.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DECK

A. Standard Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, minimum.
      a. G60/Z180 galvanized zinc coating at interior conditions.
      b. G90/Z275 galvanized zinc coating at exterior conditions.
   2. Deck Profile: As indicated on the Drawings.
   3. Profile Depth: As indicated on the Drawings.
   4. Design Uncoated Steel Thickness: As indicated on the Drawings.
   5. Span Condition: As indicated on the Drawings.
   6. Side Laps: Interlocking seam.

B. Acoustical Cellular Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 minimum, with G60/Z180 galvanized zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   2. Deck Profile: As indicated on the Drawings.
   3. Profile Depth: As indicated on the Drawings.
   4. Design Uncoated Steel Thickness: As indicated on the Drawings.
   5. Deck Unit / Bottom Plate: As indicated on Drawings.
   6. Span Condition: As indicated on the Drawings.
   7. Side Laps: Interlocking seam.
   8. Acoustical Perforations: Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck.
   9. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber factor insterted between deck bottom plate and deck flutes.
   10. Acoustical Performance: NCR 0.90, tested according to ASTM C423.

C. Composite Floor Deck: Composite type, fluted steel sheet with integrally embossed or raised pattern ribs and interlocking side laps; vented.
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G60/Z180 galvanized zinc coating.
   2. Deck Profile: As indicated on the Drawings.
   3. Profile Depth: As indicated on the Drawings.
   4. Design Uncoated Steel Thickness: As indicated on the Drawings.
   5. Span Condition: As indicated on the Drawings.

2.03 ACCESSORY MATERIALS

A. Stud Shear Connectors: Made from ASTM A 108 Grade 1015 bars.

B. Weld Washers: Mild Steelm uncoatedm 3/4" outside diameter, 1/8 inch thick.

C. Welding Materials: AWS D1.1/D1.1M.

D. Mechancial Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners: or self-drilling, self-threading screws.

E. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

G. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gauge, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On concrete and masonry surfaces provide minimum 4 inch bearing.

C. On steel supports provide minimum 1-1/2 inch bearing.

D. Fasten deck to steel support members at ends and intermediate supports as specified on the structural drawings.

E. Weld deck in accordance with AWS D1.3/D1.3M.

F. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

G. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

H. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

I. Place metal cant strips in position and fusion weld.

J. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

K. Weld stud shear connectors through steel deck to structural members below.

L. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

3.03 FIELD QUALITY CONTROL

A. Tests and Inspections: Owner will employ the services of an independent testing laboratory for performing tests and to conduct inspection services on all on?site steel deck welding required for this construction and as indicated on the Drawings.

END OF SECTION 05 3100

SECTION 05 4000

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cold-formed steel exterior wall framing.

B. Work covered by this section is subject to Alternate No. 2 Community Based Bidding (CBB) Program. The applicable CBB criteria is included at the end of this specification section.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 04 2001 - Masonry Veneer: Veneer masonry supported by wall stud metal framing.

C. Section 05 1200 – Structural Steel: Any HSS or other structural steel components within exterior wall framing as necessary for strength or deflection purposes.

D. Section 07 2100 - Thermal Insulation: Insulation within framing members.

E. Section 09 2116 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.

F. Section 09 5100 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

A. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members; 2018, with Editorial Revision.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. For each type of cold-formed metal framing product and accessory indicated.

C. Welding Certificates: If welding is to be used.

D. Shop Drawings.
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

E. Design Calculations: Provide calculations, bearing the seal and signature of a Professional Structural Engineer, employed by the Contractor and registered in Oregon, for the following:
   1. Connections that differ from those indicated in the contract documents.
   2. Requests for substitution of member sizes or material grades.
   3. Modification of the type, strength or configuration of structural framing for the convenience to accommodate builder preference, erection sequence, construction equipment, and/or material availability.

F. Research/Evaluation Reports: Current ICC-ES or IAPMO Evaluation Reports indicating that each of the following complies with requirements:
   1. Cold-formed metal framing.
   2. Expansion anchors.
   3. Power-actuated anchors.
   4. Screw fasteners.

1.06 QUALITY ASSURANCE

A. Welding: If welding is to be used, qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

B. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

D. Coordination: Coordinate additional metal framing and backing with masonry attachment points, metal panel system attachment points, and rainscreen system attachment points.

1.07 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing products by manufacturers who are members in good standing of the Steel Stud Manufacturers Association (SSMA), the Steel Framing Industry Association (SFIA), or the Certified Steel Stud Association (CSSA).

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, blocking, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as shown on the Drawings.

2.03 MATERIALS, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As indicated on the Structural Drawings; ST33H (ST230H), minimum.
   2. Coating: G60 (Z180), unless otherwise indicated on the Drawings.

B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 (Z275).

2.04 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gauge and Depth: As indicated on drawings.

B. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ClarkDietrich Building Systems.
      b. MarinoWARE.

c. SCAFCO Corporation.
d. Steel Network, Inc. (The).
e. Substitutions: See Section 01 6000 - Product Requirements.

C. Drift Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and with web slots allowing free movement in the plane of exterior wall to accommodate inelastic inter-story seismic drift.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. SCAFCO Corporation.
b. Steel Network, Inc. (The).
c. Substitutions: See Section 01 6000 – Product Requirements.

2.05 ANCHORS, CLIPS AND FASTENERS

A. Welding Electrodes: Comply with AWS standards.

B. See drawings for additions requirements.

2.06 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.07 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding or screw fastening. Wire tying of framing members is not permitted.
a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to the Drawings, with screw penetrating joined members by not less than three exposed screw threads.
4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to the Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Coordinate framing with the work and products of other Sections. Provide framing for openings using standard framing techniques and details unless specifically detailed otherwise.

3.02 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud locations to ensure a uniform bearing surface on supporting concrete construction.

D. Install sill gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud locations.

3.03 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding or screw fastening. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to the Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

K. See Structural Drawings for limitations on attachment methods to Buckling-Restrained-Braces.

3.04 EXTERIOR WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as indicated on the Drawings.

C. Set studs plumb.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical and horizontal (in-plane) loads while providing lateral (out-of-plane) support.
   1. Where shown on the Drawings, connect vertical deflection clips to bypassing studs and anchor to building structure.
   2. Where shown on the Drawings, connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on the Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection. Bridging shall be of one of the types listed below, as appropriate and as indicated on the Drawings:
   1. Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   2. Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.05 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, which ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

3.06 COMMUNITY BASED BIDDING (CBB) DOCUMENTATION

A. Submit affidavits, checklists, reports and documentation, monthly or as otherwise defined, in accordance with the Owner’s CBB criteria which follows this specification section.

END OF SECTION 05 4000

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concealed metal support for overhead grilles and doors.
B. Lintels.
C. Relieving angles.
D. Grates for elevator sump.
E. Elevator hoistway beams and guiderail supports.
F. Supplemental framing for bathroom partitions.
G. Miscellaneous supports for mechanical equipment.
H. Shop fabricated steel items.
I. Downspout boots.
J. Downspouts.
K. Pipe bollards.
L. Other items shown on the Drawings.
M. Other items not shown on the Drawings but required by some part of the Work for completeness.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.
B. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
C. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
D. Section 04 2001 - Masonry Veneer: Placement of metal fabrications in masonry.
E. Section 05 1200 – Structural Steel Framing: Structural steel bearing plates and anchor bolts.
F. Section 05 1213 – Architecturally-Exposed Structural Steel Framing.
G. Section 05 2100 – Steel Joist Framing. Bearing plates for steel joists, including anchorage.
H. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.
I. Section 05 5100 - Metal Stairs: Structural steel stair framing and supports.
J. Section 05 5133 - Metal Ladders.
K. Section 09 9113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.
C. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).
D. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2018.
G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

I. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, critical dimensions, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Indicate members to be galvanized, location and size of drain holes, and which members are to receive field finish painting that may impact the galvanizing process.

C. Furnish anchor bolt setting drawings and installation details for steel items provided by this Section.

D. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

E. Material Samples: Provide samples of exposed to view Interior Metal Fabrications, including proposed shop finishes unless the fabricator supplying the work of this section is also supplying the work in section 05 1213 - Architecturally Exposed Structural Steel Framing.
   1. Submit sample of all required welds. Approved sample will be used as the standard for all welding.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

1.06 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.
   1. Scope: Lintels.

B. Minimum 6 linear feet of steel railing & stanchions complete with pickets, brackets and connections.

C. Notify Architect when the mock-up is ready to view and prior to preparation for finishing.

D. Notify Architect again when primer coat is completed.

E. Notify Architect again when powder coating is completed.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Recycled Content: Steel W, T, HSS, Pipe, Angles, Plates, Channels, and Bars are to meet or exceed the industry standards for recycled content for the electric arc furnace process. Post-consumer content of 56%, Pre-consumer content of 32%. See the current edition of Steel Recycling Institute "Steel Takes LEED with Recycled Content; http://www.recycle-steel.org/en/Recycling%20Resources/~/media/Files/SRI/Media%20Center/LEED_Sept2011.pdf.

B. Steel channels, angles, bars, and plates: ASTM A 36/A 36M unless otherwise indicated on Drawings.

C. Steel W Shapes and Tees: ASTM A992/A992M (Fy = 50 ksi), unless otherwise indicated on the Drawings.

D. Steel Tubing and Hollow Steel Sections: ASTM A 500, Grade B cold-formed structural tubing, unless otherwise indicated on the Drawings.

E. Steel Pipe: ASTM A 53/A 53M, Grade B, with sulfur not exceeding 0.05%, (Fy=35 ksi). Finish black. Type S where exposed to view, type E where concealed from view.

F. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

G. Anchor Bolts, Headed Anchor Rods: ASTM A 307, Grade C, plain.

H. Stainless Steel Tubing: Type 304, 0.083 inch wall thickness, unless otherwise noted.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with project's VOC limitations.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with project's VOC limitations.

2.02 SITE ELEMENTS

A. Steel Pipe Bollards:
   1. Traffic Bollards: Schedule 40 steel pipe, 6-inch diameter, unless otherwise indicated, concrete filled, crowned cap, as detailed; galvanized finish.

B. Secured Bike Parking Enclosure:
   1. CNC, mechanically cut, custom enclosure panels
      a. Architect to provide digital files in common format.

2.03 METAL LADDERS

A. See Section 05 5133

2.04 ELEVATOR SUMP GRATE

A. General: Produce metal bar grating of description indicated per NAAMM marking system that complies with the following:
   1. Non-Heavy-Duty Metal Bar Gratings: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."
   2. Grating Mark W-19-4 (1-1/2 x 1/8).
   3. Welded steel, 1-1/2 by 1/8 inch bearing bars at 1-3/16 inches o.c. and crossbars at 4 inches o.c.

B. Traffic Surface for Steel Bar Gratings: Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive.

C. Fabricate removable grating with banding bars attached by welding to entire perimeter. Include anchors and fasteners of type recommended by manufacturer for attachment to supports.

D. Fabricate cutouts in grating to fit around discharge. Arrange cutout to permit grating removal without disturbing item penetrating grating.

E. Manufacturers
   1. Amico Grating: www.amico-grating.com.
   2. Indiana Gratings, Inc: www.indianagratingsinc.com.
   3. McNichols Co; www.mcnichols.com.
   4. Ohio Grating, Inc: www.ohiogratings.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

F. Provide steel frames and supports. Fabricate unit to sizes, shapes and profile required to receive grating. Fabricate from galvanized structural steel shapes. Miter and weld connection for perimeter angle frames. Cut, drill, and tap units to receive hardware, and similar items.

G. Equip unit with integrally welded anchors for casting into concrete.

2.05 AIR GRILLE

A. CNC, mechanically cut, custom air grille.

B. Material: 18ga. sheet steel.

C. Size: As shown on drawings

D. Pattern: Cut from digital vector file provided by Architect.

E. Fabrication: Mechanically cut sheet steel and brake form into shapes indicated on Drawings.

F. Location: Media Center

2.06 FASTENERS, BOLTS, ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1.
   1. Finish: Plain, except galvanized to ASTM A153/A153M where connecting galvanized components.

B. Anchor Bolts, Headed Anchor Rods: ASTM F 1554, Grade 36, unless otherwise indicated on the Drawings.

C. Powder-Driven Fasteners: Hilti DX system, or approved. Similar to Hilti DS Heavy Duty Pins.

D. Post-Installed Concrete Bolts: Simpson Titan HD, Powers Wedge-Bolt, or approved.

E. Post-Installed Concrete Screws: Simpson Titan Concrete and Masonry Screws, Hilti Kwik-Con II or approved.

F. Expansion Anchors: Hilti KB-TZ, ITW Ramset/Redhead Power-Stud, Simpson Strong Bolt Wedge Anchor, or approved: See drawings for size. Hot-dipped galvanized. Stainless steel for attachment into masonry, where exposed, or where noted.
   1. Seismic qualification tested in accordance with ACI 355.2 and ICC-ES AC 193.
   2. Meets ductility requirements of ACI 318 D 3.3.
   3. Meets ICC-ES ESR-1917.
   4. Anchors to be used in locations, configurations, and materials only as approved by the manufacturer.

G. Self-Drilling Screws: ITW Buildex, or approved; type and drill point as required for materials being fastened.

H. Epoxy Adhesive Anchors for Concrete and Concrete Block:
   1. Hilti RE 500 SD, Simpson SET XP, or approved.
   2. Concrete and Epoxy preparation as required by epoxy manufacturer's ICBO or IAPMO report.

2.07 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Provide holes and connections for work of other trades.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

G. Fabricate any Structural Connections not specifically detailed on Drawings as Directed by Architect and at no additional cost to Owner. If Directions are not obtained, fabricate consistent with balance of Design and strong enough to fully develop Members involved.

H. Form elbows and bends to uniform radii, free from buckles and twists, and with finished surfaces smooth.

I. Cap and fully weld exposed ends of pipe and tubing.

2.08 FINISHES - STEEL

A. Galvanizing: Galvanize after fabrication all items to be located on the exterior of the building to ASTM A123/A123M requirements, unless noted otherwise. Provide minimum 1.7 oz/sq ft galvanized coating.

B. Prime paint steel items, one coat.
   1. Exceptions: Galvanize and as indicated on Drawings.

2. Exceptions: Do not prime surfaces in direct contact with concrete or masonry, where field welding is required, and items to be covered with sprayed fireproofing.

C. Prepare surfaces to be primed in accordance with SSPC-SP2.

D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

2.09 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. Treat field welded areas of galvanized members with zinc solder to replace galvanized protection.

G. Touch-up Field Connections and damaged Shop Treatment areas as erection proceeds. Immediately prior to final covering, remove Rust and retreat any Members showing evidence of Rust through Shop Treatment over approximately 5% or more to total Shop Treatment area.

H. Remove loose rust, heavy Mill Scale, Oil, Dirt, and other bond-reducing Foreign Substances from Members scheduled to receive Finish Painting, or other direct-to-steel Coatings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. An independent testing and inspection agency will perform field quality control tests and inspections, as specified in Section 01 4000 and below.

1. Special inspection for post-installed concrete and masonry anchors

END OF SECTION 05 5000

SECTION 05 5100

METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel stair framing and supports for custom stairs as follows:
   1. Stair A100
   2. Stair B130
   3. Stair C102
   4. Stair C110

1.02 RELATED REQUIREMENTS

A. Section 01 3316 - Delegated Design Requirements: Sub-Contractor design and engineering procedures for design-build stair components so designated.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for treads and landings; and, placement of metal anchors in concrete.

C. Section 05 1213 - Architecturally-Exposed Structural Steel: Additional requirements for fabricated steel members designated as architecturally-exposed structural steel (AESS).

D. Section 05 7300 - Metal Guards and Railings: Metal guards and handrails for the stairs specified in this section.

E. Section 09 9600 - High-Performance Coatings: Priming and painted finish.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASCE/SEI 7 – Minimum Design Loads for Buildings and Other Structures 2016.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2019.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019, with Editorial Revision (2020).

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. At design-build stair components, include the design engineer's seal and signature on each sheet of shop drawings.

C. Design Data: As required by authorities having jurisdiction.
   1. Delegated Design Submittal. Comply with Section 01 3316 - Delegated Design .

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: At design-build stair components.
   1. Professional Engineer experienced in design of this work and licensed in Oregon, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

1.06 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project in time for installation.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: At design-build stair components, engage a qualified professional engineer to design treads, including attachment to reminder of stair construction.
   1. Structural Performance of Stair Components: Metal stair components shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
      a. Uniform Live Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
      b. Concentrated Live Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
      c. Uniform and concentrated loads need not be assumed to act concurrently.

2.02 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Dimensions: As indicated on drawings.
   2. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   3. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   4. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Comply with requirements of Section 05 1213 - Architecturally-Exposed Structural Steel
      a. Comply with AISC 303, Section 10 for specific AESS as follows:
         1) Intererior Stair and Railing Assemblies: AESS 2

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.03 METAL STAIRS WITH PRECAST CONCRETE TREADS

A. Jointing and Finish Quality Level: Architecturally-Exposed Structural Steel, as defined above.

B. Risers: Refer to stair details.

C. Treads: Delegated-design, compliant with performance requirements indicated and as follows..
   1. Tread Thickness: 1-1/2 inches, minimum or as otherwise indicated on the Drawings.
   2. Tread Anchorage to Stringers: Design-build connections welded or bolted to carrier angles welded or bolted to stringers.
   3. Concrete Reinforcement: Welded wire mesh.
   4. Concrete Finish: As shown on drawings.

D. Stringers: As indicated on drawings.

E. Railings and Guards: As indicated on drawings and specified in Section 05 7300 - Metal Guards and Railings.

2.04 METAL STAIRS WITH METAL PLANK TREADS

A. Jointing and Finish Quality Level: Architecturally-Exposed Structural Steel, as defined above.

B. Risers: Closed.
   1. Provide perforated risers
   2.

C. Treads: Plank Grating.
   1. Tread Material: Plank - GRIP STRUT by McNichols, or Approved Equal
      a. Primary Material: Galvanized Steel
      b. Alloy, Grade or Type: ASTM A-653 G90
      c. Material Finish: Mill Finish
      d. Gauge/Thickness: 12 gauge, 0.080 inch minimum
      e. Surface Profile: 5-diamond GRIP STRUT Plank
      f. Surface Width: 11-3/4 inch
      g. Channel Depth: 2- 1/2 inches
      h. Product Surface: Serrated
      i. Percent open Area: 35%
      j. Planks cut to length with standard stair tread end plates attached.
   2. Anchorage to Stringers: Bolted to carrier angles bolted to stringers.

D. Risers: As indicated on the drawings.

E. Stringers: As indicated on the drawings.

F. Railings: As indicated on the drawings and as specified in section 05 7300..

2.05 HANDRAILS AND GUARDS

A. As shown on drawings. See Section 05 7300.

2.06 MATERIALS

A. Steel Sections: ASTM A 36/A 36M, unless otherwise indicated on the Drawings.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M, unless otherwise indicated on the Drawings.

D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Sheet Metal for Risers: Sheet steel panels with perforations where indicated on Drawings:
   1. Holes: Round hole pattern 0.375 rd by 0.2500 staggered pattern perforations.
   2. Thickness: 0.06-inch, 12 gage.
   3. Manufacturer: Diamond Manufacturing Company: www.diamondman.com or equal.
   4. Refer to details for extent.

2.07 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.08 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
   1. Follow process for the preparation of the steel members recommended by high-performance paint manufacturer for interior and exterior applications.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Preparation and Primer: As specified in Section 09 9600 - High Performance Coatings.

D. Finish Painting: Field applied as specified in Section 09 9600 - High Performance Coatings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION 05 5100

SECTION 05 5133

METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall ladders

B. Safety Post

C. Mounting Hardware

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Fabricated elevator pit ladders

B. Sections 07 7200 Rood Accessories: Roof Hatch

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.

C. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.05 QUALITY ASSURANCE

A. A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Requirements.

B. Provide manufacturer's standard product warranty.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Install ladder safety system in accordance with manufacturer's instructions.

C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Do not cut components unless approved by the manufacturer.

E. Secure ladders to floor/wall construction as appropriate. Do not attach ladders to roofed surfaces.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 5133

SECTION 05 7300

METAL GUARDS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Railing and guard assemblies.

B. Wall-mounted handrails.

C. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Supports.

B. Section 05 5100 - Metal Stairs: Handrails other than those specified in this section.

C. Section 09 2116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

1.03 REFERENCE STANDARDS

A. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.

B. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

C. AWS D1.6 - Structural Welding Code - Stainless Steel; 1999.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

C. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.

1.05 MOCK-UP

A. Minimum 6 linear feet of steel guard and railing complete with pickets, brackets and connections.

B. Locate where directed by Achitect

C. Approved portion may remain as part of work.

PART 2 PRODUCTS

2.01 HANDRAILS AND GUARDS

A. Handrails at Interior Stairs: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.

1. Design Criteria: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
    a. Lateral Force: 75 lb minimum, at any point, when tested in accordance with ASTM E935.
    b. Distributed Load: 50 pounds per foot minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
    c. Concentrated Loads on Intermediate Rails: 50 pounds per square ft, minimum.
    d. Concentrated Load: 200 pounds minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
3. Joints: Tightly fitted and secured, machined smooth with hairline seams.

4. Field Connections: Provide sleeves to accommodate site assembly and installation.
5. Welded Joints: Make exposed joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
    a. Ease exposed edges to small uniform radius.
    b. Welded Joints:
        1) Carbon Steel: Perform welding in accordance with AWS D 1.1/D1.1M.
6. Round pipe rails, unless otherwise indicated.
    a. Outside Diameter: as indicated on Drawings.
7. Material and finish: Provide steel railing with high performance coating at stairs and where indicated on Drawings.
8. Provide wall returns, extensions, and posts where required or indicated.
9. Brackets: Provide fabricated steel brackets as shown on drawings. Material and finish to match handrail.
10. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.
11. Extent: Provide handrails at all stairs and where shown on drawings. Wall mounted and guard mounted.

B. Guards at Interior Stairs:
1. Top Rails:
    a. Architectural Stairs: Steel shapes as shown on drawings.
2. Infill at Architectural Stairs: Perforated steel panels.
    a. Panel Thickness: 12 gage.
    b. Perforation Pattern: 1/4 inch round perforations, 3/8 inch on center.
3. End and Intermediate Posts: Same material and size as top rails, unless otherwise detailed.
    a. Horizontal Spacing: As indicated on drawings.
    b. Mounting: Welded to top surface of stringer.

C. Handrails - Exterior Stairs and Ramps:
1. Stanchions: ASTM A283/A283M plate steel in thickness as indicated on Drawings.
2. Handrails: ASTM A 53/A 53M, Grade B Schedule 40, steel pipe.
3. Dimensions and configuration: as indicated on Drawings or as required by code.
4. Finish: Hot-dipped galvanzied after fabrication to ASTM A123/A123M requirements.

2.02 MATERIALS

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

C. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

E. Perforated Metal for Railing Infill: Steel panels with perforations as follows:
1. Holes: Round hole pattern 0.375 rd by 0.2500 staggered pattern perforations.
2. Thickness: 0.06-inch, 12 gage.
3. Manufacturer: Diamond Manufacturing Company: www.diamondman.com or equal.
4. Refer to details for extent.

F. Steel Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

G. Welding Materials: AWS D1.1; type required for materials being welded.

H. Shop and Touch-Up Primer for Interior Ferrous Metal: Either Tnemec Series 115 Uni-Bond DF at 2 mils DFT or primer specified in Section 09 96 00 - High-Performance Coatings for full-gloss, two-component, waterborne pigmented aliphatic acrylic polyurethane, complying with VOC limitations specified in Section 09 96 00.

2.03 ACCESSORIES

A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

B. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
   3. For anchorage to stud walls, provide backing plates for bolting anchors.
   4. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.02 PREPARATION

A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.

B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.

END OF SECTION 05 7300

SECTION 06 1000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof-mounted curbs.

B. Roofing nailers.

C. Manufactured lumber.

D. Preservative treated wood materials.

E. Fire retardant treated wood materials.

F. Communications and electrical room mounting boards.

G. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry

B. Section 07 2500 - Weather Barriers: Air barrier over sheathing.

C. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2018.

D. OSSC - Oregon Structural Specialty Code; latest edition.

E. PS 1 - Structural Plywood; 2009 (Revised 2019).

F. PS 20 - American Softwood Lumber Standard; 2020.

G. WWPA G-5 - Western Lumber Grading Rules; 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials.

C. Samples: For rough carpentry members that will be exposed to view, submit two samples, 6by6 inch in size illustrating wood grain, color, and general appearance.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Provide FSC certified wood, as described in Section 01 35 16.04.

C. Provide wood harvested and milled within 500 miles of the project site.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Western Wood Products Association; WWPA G-5.

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Underlayment: APA Underlayment; plywood, Exposure 2, 1/2 inch thick. Fully sanded faces at resilient flooring.

B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; fire-treated so as to have flame spread index of 25 or less, smoke developed index of 450 or less when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Machine Bolts, Nuts, Washers, and Screws: Conforming to ASTM A307, galvanized where exposed.
   3. Lag Bolts and Wood Screws: ANSI/ASME B18.6.1-1981, zinc plated.
   4. Threaded Rods: ASTM A36 or ASTM A307.
   5. Anchor Bolts: ASTM A 307, Grade C.
   6. Washers: Provide Hot-dip Galvanized Steel Washers under Bolt Heads, Lag Heads, and Nuts adjacent to all wood framing members.
   7. Epoxy Anchors: Hilti HIT HY-150 Max (at CMU); Hilti HIT-RE 500 SD (at concrete), or approved.
   8. Powder Actuated Fasteners:
      a. To Steel: "DS with Washer", by Hilti, "Power Point with Washer", by Ramset/Redhead, or approved.
      b. To Concrete (non-seismic applications only): "DN72 with Washer", by Hilti, or approved.
      c. To Concrete Masonry (non-seismic applications only): "DXE72 with Washer", by Hilti, or approved.
   9. Self-drilling screws to light-gage framing: Traxx by ITW Buildex or approved; with break-off wings, flat or bugle head.

B. Sill Gasket on Top of Foundation Slab/Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: 1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

b. Treat lumber in contact with roofing, flashing, or waterproofing.
c. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

B. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

B. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.

C. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

D. Do not notch, bore, or drill framing members except as noted on Drawings, or as approved by Engineer.

E. Do not install composite lumber in contact with concrete. Provide treated dimension lumber for plates in contact with foundations.

F. Provide preservative-treated wood nailers on roof deck as indicated on Drawings or as required by membrane roofing manufacturer.
1. Coordinate thickness of nailer with thickness of roof insulation.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Items that require blocking include:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Toilet, Bath and Laundry accessories, including OFCI items.
6. Wall-mounted door stops and hold open devices.

7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.
10. Toilet partitions.
11. AV equipment, including monitors.
12. Other wall-mounted items requiring support but not on this list.

3.05 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.06 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.
   4. Size and Location: 48 by 96 inches, and/or as indicated on Drawings.

B. Install panels with a minimum 1/16 inch, maximum 1/8 inch gap between adjoining panels.

3.07 ACCESSORIES AND FASTENER INSTALLATION

A. Provide Washers under Nuts and Heads when making Bolted or Lag Screwed connections.

B. Drive Nails perpendicular to Grain in lieu of toe-nailing where feasible.

C. Lag Screws: Pre-drill to 70% of the shank diameter in supporting member, 1/32 to 1/16 inch larger than shank diameter in attached members. Use standard cut washer between bolt head and wood. Install Lag Screws by turning, do not drive with hammer.

D. Nails and Screws: Fasten members as shown on Drawings. Predrill holes as required to prevent splitting of members. Nailed connections not shown on Drawings or specified by manufacturer shall conform to the building code.

E. Bolts: Set in holes 1/32 inch to 1/16 inch larger than bolt through wood member. Tighten to snug position. Use cut washer between nut or bolt head and wood.

F. Powder-Driven Connectors: Select size and type for full penetration into substrate without splitting connected wood members or fracturing substrate. Use washer under head to prevent over-driving.

3.08 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.09 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION 06 1000

SECTION 06 2000

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior and exterior finish carpentry items, including running trim and panel material.

B. Interior Hardwood benches

C. Wood paneling wainscot, WSCT-1

D. Plastic laminate wainscot, WSCT-2

E. Window Sills (Hardwood Plywood- Appleply)

F. Hardware and attachment accessories.

G. Shop Finishing

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 09 6566 - Wood Athletic Flooring: Seating at concrete plinths

D. Section 09 9000- Painting and Coating: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

B. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

C. PS 1 - Structural Plywood; 2009 (Revised 2019).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. WP-1& WP-2 Material for Finish Carpentry and Architectural Wood Casework to be purchased from same lot and finished by same finisher.

1.05 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide instructions for attachment hardware and finish hardware.
   2. For installation adhesives, include printed statement of VOC content.
   3. For each composite-wood product used, provide documentation indicating that the bonding agent contains no urea formaldehyde.
   4. For each adhesive used, provide documentation indicating that the adhesive contains no urea formaldehyde.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide the information required by AWI/AWMAC/WI (AWS).

D. Samples:
   1. Submit 2 samples of wood trim 12 inches long with specified finish.
   2. Submit 2 samples of each type of wood panel 12 inches square with specified finish.
   3. Submit 2 samples of each plastic laminate color specified.
   4. Submit two samples of each lumber trim species specified, 12 inches long.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so Postconsumer recycled content plus one-half of preconsumer recycled content is not less than 20 percent.

C. Formaldehyde Free Panel Products: Provide fiberboard, particleboard and plywood products made with binders and adhesives containing no urea formaldehyde.

1.07 MOCK-UP

A. Wood Trim:
   1. Provide one mock-up for each trim type. Mock up to include at least two pieces of material, at least one joint of every major type, and each type of fastener.
   2. Locate where directed on drawings.
   3. Mock-up may remain as part of the Work.

B. Wood Paneling Wainscot, WSCT-1:
   1. Provide a mock up section of the wood paneling showing backing, finish panels, fasteners, and joint treatment at corners and butt joints.
   2. Locate where directed.
   3. Mock-up may remain as part of the Work.

C. Plastic Laminate Wainscot, WSCT-2:
   1. Provide a mock up section of the wood paneling showing backing, finish panels, fasteners, and joint treatment at corners and butt joints.
   2. Locate where directed on drawings
   3. Mock-up may remain as part of the Work.

D. Built-Up Wood Panel Relief
   1. Provide a mock up of one built-up wood panel relief system showing backing, finish panels, fasteners, and joints.
   2. Locate where directed on drawings
   3. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

B. Protect material from discoloration due to uneven exposure to light.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI (AWS) for Premium Grade.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by OSSC 803.1.1 Class C and other applicable codes..

C. Interior Woodwork Items:
   1. Moldings and Miscellaneous Trim: White Maple; prepare for stained finish.
   2. Window Sills: Hardwood plywood (Appleply).
   3. Communications and Electrical Room Mounting Boards: See Section 06 1000 Rough Carpentry.
   4. Wall Paneling (WSCT - 1): Hardwood Plywood (Appleply)
   5. Wall Paneling (WSCT - 2): Plastic laminate faced softwood plywood core
   6. Built- Up Wood Panel Relief: Hardwood Plywood (Appleply); prepare for stained finish where indicated
   7. Hardwood Interior Benches: White Maple; clear finish
   8. Hardwood Seating at concrete plinths: Wood Athletic Flooring with White Maple trim.

9. Panels at Retractable Stage: Plywood.

2.02 LUMBER MATERIALS

A. Interior Hardwood Trim: White Maple species; PS 20, AWI Premium Grade; plain sawn, smooth texture; mixed grain; maximum moisture content of 6 percent; suitable for stained finish.
   1. Profile: As shown in drawings
   2. Minimum lengths: Opening & Standing Trim: 1 piece, single length. Running Trim: Joints minimum 12 feet apart.
   3. Extent of Work: Wood trim above WSCT-1 and as shown on drawings.

B. Interior Hardwood Bench: White Maple species; PS 20, AWI Premium Grade; plain sawn, smooth texture; mixed grain; maximum moisture content of 6 percent; suitable for clear finish.
   1. Size: 1 inch thick x 9 1/4 inches wide. Provide lengths to reduce number of running joints.
   2. Edges: Ease edges
   3. Extent of work: Benches, where indicated on drawings.

2.03 SHEET MATERIALS

A. ApplePly Plywood: White Maple species; AWI Premium Grade; PS 51; plain sliced; random match; no voids in core; faced on both sides.
   1. Match work of other sections: Apple Ply product in Section 06 2000 Finish Carpentry to match product used in Section 06 4100 Architectural Wood Casework.
   2. Manufacturer: Apple-Ply by States Industries, Europly by Colombia Forest Products, or approved.
   3. Thickness: 1/2-, 3/4- and 1-inch, as indicated on drawings.
   4. Extent: WP-1 & WP-2 as indicated on drawings.

B. Softwood Plywood Not Exposed to View: Any face species, veneer core; PS 1 Grade A-B; glue type as recommended for application.
   1. Extent: For use as substrate for Plastic Laminate Wainscots, Wall Panels, and as shown on drawings.

2.04 PLASTIC LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
   1. Provide specific types as follows:
      a. Horizontal Surfaces: HGS, 0.048 inch nominal thickness.
      b. Vertical Surfaces: VGS, 0.028 inch nominal thickness.

B. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.

C. Colors: As scheduled on drawings.

2.05 FASTENINGS

A. Fasteners: Of size and type to suit application.

B. Panel Z Clips: 6063 aluminum clips, 1/4 inch thick by full length of panel.
   1. Manufacturer: Panelclip manufactured by Brooklyn Hardware LLC Manufacturing, and MF 250 Z-Clip by Monarch Metal Fabricators.

2.06 ACCESSORIES

A. Adhesive: Type recommended by laminate manufacturer to suit application.
   1. Do not use adhesives that contain urea formaldehyde.
   2. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Wood Glues: 30 g/L.

B. Edge trim for Plastic Laminate Wainscots and Wall Panels:

1. "J" Molding JDM-625 manufactured by Fry Reglet Corporation; www.fryreglet.com
2. Finish: Clear Anodized.
3. See drawings for locations.

C. Wood Filler: Solvent base, tinted to match surface finish color.

D. Stainless Steel Sill for Book Drop
1. Material: ASTM A167m Type 202/304, soft temper, 20 gauges, Number 4 finish
2. Wrap edges, miter, weld and grind corners smooth, profiles as shown on drawings.

E. Gasket: Neoprene strip; self-adhering type; 1/2 x 1/4 inch size. For use at media workstation desk at book return.

2.07 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

C. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

D. Plastic Laminate Wainscots and Wall Panels: Fabricate with 1/2-inch thick plywood backer, unless otherwise indicated, as detailed:
1. Conform to AWI Custom quality standards.
2. Apply plastic laminate over plywood, adhered with adhesive over entire surface.
3. Apply adhesive over entire back surface of panels and adhere to gypsum board or other wall substrate. Attach wainscot panels at top corners and at two intermediate points equally spaced along top. All fasteners to be concealed.
4. Provide self-edge at all joints.

E. Fabricate hardwood trim from hardwood lumber. Ease all edges 1/16-inch.
1. Finish: Satin with conversion varnish finish.

2.08 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
1. Transparent:
a. Stain: Where occurs, as selected by Architect.
b. System - 5, Varnish, Conversion.
c. Sheen: Semigloss.

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

C. Verify that gypsum board substrates have relieved a coat of primer prior to installation of wainscots and wood panels.

D. Verify the substrates behind open joints between wainscots and between adjacent wall panels have been painted black prior to installation of panels.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Miter corners.

E. Use concealed fasteners wherever possible, unless noted otherwise on Drawings.

F. At fasteners installed through the exposed surface(s) of the trim, countersink and/or set fasteners low enough to accommodate wood plugs or wood filler.

G. At Appleply Panels, install with Attachment Clips as shown on the Drawings.
   1. Paint substrate behind panels as indicated on Drawings for exposed reveal joints.
   2. Install reveal and trim pieces as detailed.
   3. Space panels as detailed on Drawings.

H. Plastic Laminate Wainscots: Install wainscot panels with adhesive suitable for application, unless detailed otherwise. Do not face nail.
   1. Paint substrate behind panels as indicated on Drawings for exposed reveal joints.
   2. Install reveal and trim pieces as detailed.
   3. Space panels as detailed on Drawings.

I. ApplePly Sills: Install window sills plumb, level, true, and straight as shown on Drawings, set in full bed of adhesive. Brace in place and protect from movement. Scribe window sills to fit where required by site conditions

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION 06 2000

SECTION 06 4100

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

C. Factory finishing.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 4000 - Cold Formed Metal Framing: Support framing, grounds, and concealed blocking.

C. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

D. Section 06 2000 - Finish Carpentry

E. Section 07 9005 - Joint Sealers

F. Section 08 8000 - Glazing: Glass for casework.

G. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

E. PS 1 - Structural Plywood; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. WP-1 Material for Finish Carpentry and Architectural Wood Casework to be purchased from same lot and finished by same finisher.

1.05 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, fastening methods, jointing details, connections to adjacent work, schedule of finishes, and accessories.

C. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

D. Resubmitted of Shop Drawings: If field measurements result in significant changes to the casework design, resubmit all shop drawings after field dimensions have been verified.
   1. Indicate on resubmitted drawings all dimensions which were verified.
   2. Indicate significant changes to casework resulting from field-measured conditions. Do not proceed with fabrication until approved by Architect.

E. Product Data: Provide data for panel products, countertop materials and hardware accessories.
   1. Product catalog for hanging display system indicating available fittings.
   2. For installation adhesives, include printed statement of VOC content.
   3. For each adhesive used, provide documentation indicating that the adhesive contains no urea formaldehyde.

F. Samples:
   1. Submit two samples of each plastic laminate color specified, 4 inch x 5 inch size.

2. Submit two samples of each plastic laminate edge banding, 12 inches long
3. Submit two samples of each hardwood veneer species specified, 12 inch x 12 inch size, indicating cut and color of material used on this project.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so Postconsumer recycled content plus one-half of preconsumer recycled content is not less than 20 percent.

C. Formaldehyde Free Panel Products: Provide fiberboard, particleboard and plywood products made with binders and adhesives containing no urea formaldehyde.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver casework to jobsite until notified by General Contractor that Project is conditioned and prepared to handle and store casework without damage or discoloration.

B. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI//AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Hardwood Plywood (Appleply) Faced Cabinet:
1. Exposed Surfaces: HPVA Grade A, White Maple, plain sliced, book-matched.
2. Semi-Exposed Surfaces: HPVA Grade B, White Maple, plain sliced, pleasing-matched.
3. Concealed Surfaces: Manufacturer's option.

C. Cabinet Construction Type: Type A, Frameless

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LAMINATE MATERIALS

A. Manufacturers:
1. Formica Corporation: www.formica.com.
2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.
3. Wilsonart, LLC: www.wilsonart.com.
4. Pionite: www.pionite.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

C. Provide specific types as indicated.
1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through colorthrough color,, finish as indicatedfinish as scheduled.
2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through colorthrough color,, finish as indicatedfinish as scheduled.
3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through colorthrough color,, finish as indicatedfinish as scheduled.
4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 PANEL MATERIALS

A. ApplePly (Plywood): Veneer core panels constructed from uniform lamination of solid grade 1/16-inch thick alder and birch, White Mape Species Veneer.
   1. Thickness: 3/4 inch, unless otherwise indicated.
   2. Match work of other sections: Apple Ply product in Section 06 2000 Finish Carpentry to match product used in Section 06 4100 Architectural Wood Casework.
   3. Approved products: ApplePly manufactured by States Industries: www.statesind.com. or Europly Plus by Columbia Forest Products.
   4. Extent of Work: Where WP-1 & WP- 2 is indicated on drawings.

B. Softwood Plywood Not Exposed to View: Any face species, veneer core; PS 1 Grade A-B; glue type as recommended for application.
   1. Extent: For use as substrate for Plastic Laminate.

C. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S); use for drawer bottoms, dust panels, and other components indicated on drawings.
   1. Provide prefinished hardboard for cabinet drawer bottoms.

2.05 COUNTERTOPS

A. Countertops: See Section 12 3600.

2.06 ACCESSORIES

A. Adhesive: Type recommended by AWI/AWMAC to suit application.

B. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Contact Adhesive: 250 g/L.

C. Glass: As specified in Section 08 80 00.
   1. Type 2 at bi-passing doors. Provide ground pulls.
   2. Type 2 at display cases, unless otherwise indicated.

D. Glass Stops: Removable rigid PVC glass stops.

E. Casework Ventilation Panels: Perforated steel panels.
   1. Panel Thickness: 16 gage.
   2. Perforation Pattern: 1/4 inch round perforations, 3/8 inch on center.
   3. Sizes: As indicated on casework types drawings.
   4. Finish: High performance paint, HP-1 on drawings

F. Fasteners: Size and type to suit application.

G. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; chrome-plated finish in concealed locations and stainless steel finish in exposed locations.

H. Concealed Joint Fasteners: Threaded steel.

I. Countertop Grommets: Plastic, with removable cap, black color, 3 inch O.D.; similar to "XG1" by Doug Mockett & Company, or approved.

J. Door Silencers: Rubber to prevent noisy door to frame contact.

K. Provide clear rubber cabinet door bumpers at locations where cabinet doors or pulls hit adjacent walls, window sills, or other building elements.

2.07 HARDWARE

A. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated shelf rests, nickel plated finish, for nominal 1 inch spacing adjustments.

B. Drawer and Door Pulls: Angled Bar pull, stainless steel with satin finish, 5 inch centers.
   1. Available Products:

a. No. A553-128-55 manufactured by EPCO: www.epcohardware.com.
b. No. DP54 manufactured by Mockett; www.mockett.com

C. Drawer and Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish. Key to building master keyway.
1. Lock Manufacturer: Olympus Lock, Inc.
a. Products:
1) Door Locks: 100DR N Series; National Keyway.
2) Drawer Locks: 200DW, N Series; National Keyway.
b. Provide strike plates for each lock.
c. Finish: 626.
2. Coordinate with Work of Section 08 71 00 - Door Hardware for correct keying of locks.

D. Catches: Magnetic.
1. Product: 592 manufactured by EPCO: www.epcohardware.com, or approved equal.

E. Elbow Catches: Cadmium plated steel; install on left-hand door of double door cases where locks are indicated.
1. Products: No. 2 Elbow Catch manufactured by Ives: http://us.allegion.com/brands/ives, or approved equal.

F. Drawer Slides:
1. Type: Full extension.
2. Typical Drawers: Steel ball bearings, full extension, progressive action, side mounting, with load rating of 170 pounds or greater with polymer stop cushions.
3. File Drawers: Steel ball bearings, full extension, progressive action, side mounting, with load rating of 200 pounds with hold-in feature to prevent bounceback.
a. Available Products:
1) Model 4032 manufactured by Accuride International, Inc: www.accuride.com.
2) No. 8500 manufactured by Knape & Vogt: www.knapeandvogt.com.

G. File Drawer Accessories: Provide hanging file system at all file drawers.

H. Hinges: Five knuckle, fixed pin in chrome finish. Steel hinge 2-3/4 inches high with 270 degree opening.
1. Finish: 26D Satin Chrome.
2. Available Products:
a. No. EBB-1-26D-03 manufactured by E.B. Bradley Co: www.ebbradley.com.
b. No. 376 manufactured by RPC Rockford Process Control, Inc., www.rockfordprocess.com.

I. Display Case Rolling Door Hardware: Provide complete assemblies including, but not limited to, top and bottom track, lock assembly, shoe filler, pull, molding, jamb, end caps, wheels, retainers and bumpers.
1. 2-Door Display Cases: Model No. 610187 manufactured by Stylmark: www.stylmark.com.
2. Lock: No. 510808 manufactured by Stylmark: www.stylmark.com.
3. Substitutions: See Section 01 60 00 - Product Requirements.

J. Casters for Mobile Casework: 5-inch diameter, ball-bearing, minimum 300 lb. capacity.
1. Swivel Casters:
a. No. 5-30-213G-2/No. 5-30-213-2PL manufactured by Jarvis Caster: www.jarviscaster.com.
b. No. 5-40-213F-2/No. 5-40-213F-2 with Maxi Lock Brake manufactured by Vulcan Industries, Inc.: www.vulcan-industry.com.
c. Provide locking casters at front wheels of each piece of mobile casework.
2. Distributor: Industrial Caster and Wheel, Phone 503.598.9722: www.icwco.com.

K. Bumpers (Book Return Cart): Non-marking thermoplastic rubber; white; center screw; 5/8 inch diameter, 1/4 inch thick; Durometer of 87.
1. Product:
a. RubberFeet Model DF6T-TPR87-W: www.rubberfeet.us

b. Substitutions: See Section 01 60 00 - Product Requirements.

L. Clothes Rods: Steel tube closet rod, bright chrome finish with mid-span support for shelf widths over 48-inches.
   1. Products:
      a. Rod: No. 770-1 manufactured by Knape & Vogt: www.knapeandvogt.com.
      b. Rod Support Flanges: No. 734 manufactured by Knape & Vogt: www.knapeandvogt.com.
      c. Mid-Span Support: No. 760ANO manufactured by Knape & Vogt: www.knapeandvogt.com.

M. Coat Hooks: Dull chrome finish wardrobe hook.
   1. Products:
      a. Cubbies Under-Shelf Mount: No. 580 manufactured by Ives: http://us.allegion.com/brands/ives.

N. Countertop Support Brackets:
   1. Type - 1: Brunswick Countertop Bracket SKU: 30125 manufactured by Federal Brace; www.federalbrace.com
      a. Color: Stainless
      b. Size: Verify length suitable for countertop depth
   2. Type - 2: Front Mounting Bracket - Hidden manufactured by Centerline Brackets; wwww.countertopbracket.com
      a. Color: Black
      b. Size: Verify length suitable for countertop depth

2.08 FABRICATION

A. Laminate Finished Surface Definitions: Comply with requirements of AWI/AWMAC Architectural Woodwork Quality Standards Illustrated and the following:
   1. Exposed portions of casework include all surfaces visible when doors and drawers are closed, interior faces of cabinet doors and exposed surfaces of open cases including top and bottom of shelving, interior cabinet surfaces visible behind glass doors.
   2. Semi-exposed surfaces of casework include those members behind opaque doors such as shelves, drawers, dividers, interior faces of ends, case backs and backs and bottoms.
   3. Concealed portions of casework include sleepers, dust panels, and other surfaces not visible after installation.

B. Cabinet Style: Type A Frameless or Flush Overlay.

C. Drawer Construction Technique: Lock shoulder joints.

D. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

E. Construct cabinets without integral base. Provide separate structural base as specified below.

F. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

G. Cabinet Backs: Provide minimum 1/2-inch thick cabinet back. Where back of cabinet is exposed to view, provide 3/4-inch applyply finished panel.

H. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

I. Base Construction: Construct cabinet bases of 3/4-inch thick marine grade plywood, glued and screwed. Provide reinforcing blocks as required for maximum strength. Recess base for toe space as indicated. Set base on floor where casework is to be installed. Level top surface and scribe bottom surface to floor line leaving a height of 4-inches between floor and bottom of casework.

J. Drawers:
   1. Fronts: One piece 3/4-inch thick, appleply on all four sides.
   2. Sides: 1/2-inch thick medium density overlay plywood.

3. Back and Sub-Front: 3/4-inch thick plywood.
4. Edge band top edges of sides, backs and sub-front.
5. Bottoms: Minimum 1/2-inch plywood or 1/4-inch hardboard set into 1/4-inch deep grooves at front, back and both sides.
6. Drawer Reinforcement: Reinforce drawer bottoms in excess of 400 square inches in area with 1 inch by 3 inch wood strip running front to back centered on drawer.
7. Fabricate drawers full depth of cabinet.
8. Mount drawers with positive in and out stops.

K. Cabinet Doors: 3/4-inch thick appleply on all edges.
1. Provide hinges in the following quantities:
   a. Two hinges for doors up to 36 inches high, 24 inches wide.
   b. Three hinges for doors up to 48 inches high, 24 inches wide.
   c. Four hinges for doors up to 82 inches high, 24 inches wide.
   d. For doors in excess of dimension indicated above, comply with hinge manufacturer's recommendations for size and weight of door.
2. Surface apply hinges, do not let-in hinges.

L. Semi-Exposed Cabinet Shelving: Provide hardwood plywood as follows:
1. 3/4-inch thick appleply for shelving less than 32 inches wide.
2. 1-inch thick appleply for shelving more than 32 inches wide.
3. Provide "Line Bored" multi-hole shelf support holes.
4. Allow 1/16-inch clearance at each end of loose shelving (1/8-inch overall) for ease of moving shelves.

M. Filler Panels: Provide 3/4 - 1 -inch thick filler panels covered with matching appleply finish to fill in all voids between cabinets and walls.

N. Media Center Shelving: Appleply construction with exposed edges. See drawings.

O. Plastic Laminate, General: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
2. Balanced construction on all laminate-finished panels is mandatory. Unfinished stock surfaces, including all concealed surfaces and edges will not be permitted.

P. Provide cutouts for plumbing fixtures, outlets, and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

Q. Provide square cut outs in cabinet doors where shown on drawings. Fabricate cut outs with smooth edges slightly eased. Cleanly cut inside corners.

R. Shop glaze glass materials using the Interior Dry method specified in Section 08 8000.

2.09 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing for Grade specified and as follows:
1. Transparent:
   a. System - 5, Varnish, Conversion.
   b. Sheen: Semigloss.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

G. Install countertop grommets where indicated on drawings

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 06 4100

SECTION 06 8205

FIBERGLASS REINFORCED PLASTIC PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced polyester panel system for adhesive mounting.

B. Moldings, adhesive, and joint sealants.

1.02 REFERENCES

A. ASTM D 523 - Standard Test Method for Specular Gloss; 1989 (Reapproved 1999).

B. ASTM D 570 - Standard Test Method for Water Absorption of Plastics; 1998.

C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 2003.

D. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Maintenance Instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.05 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 absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Marlite "FRP Panels"
   2. Sequentia "Structoglas"
   3. Crane "Kemlite Glasboard-P with Surfaseal" : www.frpdesignsolutions.com

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEM

A. Plastic Panel System: Factory finished panels, trim, sealant, and accessories.

B. Backing: Water Resistant and Standard Gypsum Board Specified in Section 09260

C. Surface Pattern: Smooth

D. Color: White

E. Primers, Sealers, and Adhesives: Water-resistant type recommended by manufacturer.

F. Joint Sealant: Clear translucent silicone.

G. Trim and Accessories: Provide all One and Two Piece Vinyl Moldings and Nylon Drive Rivets for a complete moisture resistant installation.

H. Thickness: 3/32 inch, nominal.

I. Panel Width: 48 inches.

J. Panel Height: 96 inches.

K. Location: As indicated on drawings

L. FRP Edge Trim: Provide all one piece metal edge trim and butt joint trim for a complete moisture resistant installation.
   1. Material: Manufacturer's standard Aluminum trim. Single piece in vertical runs, longest practical lengths in horizontal runs.
   2. Provide typical Division Bar, Inside Corner, Outside Corner,and End Caps.

2.03 ACCESSORIES

A. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by manufacturer.
   1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that Surfaces to receive Paneling are accurately sized and located, dry, clean, smooth, sound, secure, free from conditions that would damage Paneling, impair adhesive-bond, or mar Paneling finished appearance, and are otherwise properly prepared.

C. If substrate preparation is the responsibility of another installer, notify General Contractor of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Take panels out of cartons and allow to acclimatize to room conditions for at least 48 hours 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.

C. Clean surfaces thoroughly prior to installation.

D. Protect existing surfaces from damage due to installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use the adhesives recommended by the panel manufacturer unless prohibited by local regulations; obtain manufacturer's approval of alternative adhesives.

C. Install continuous bead of silicone sealant in each joint and trim groove and between trim and adjacent construction, maintaining 1/8 inch expansion space.

D. Avoid contamination of panel faces with adhesives, solvents, or cleaners; clean as necessary and replace if not possible to repair to original condition.

E. Protect installed products until completion of project.

F. Touch-up, repair or replace damaged products after Substantial Completion.

END OF SECTION 06 8205

SECTION 07 1400

FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-Applied Waterproofing: Cold applied elastomeric waterproofing for below grade walls where there is fill on the opposite side of the wall - i.e at the CMU above footings.
   1. Cold-applied modified-polymer elastomeric waterproofing.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrate.

B. Section 07 2100 - Thermal Insulation: Insulation used for protective cover over drainage board.

1.03 REFERENCE STANDARDS

A. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.

E. Warranty:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's certification that installation complies with warranty conditions for the waterproofing membrane.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

A. Construct mock-up consisting of 100 sq ft of horizontal and vertical waterproofed panel; to represent finished work including internal and external corners, drainage panel, base flashings, control joints, expansion joints, counterflashings, and protective cover.

B. Locate where directed.

C. Mock-up may remain as part of this Work.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

B. Cold applied elastomeric membrane should be stored in closed containers.

C. Store membrane at temperature of 40 degrees F and above to facilitate handling.

D. Store adhesives and primers at temperatures of 40 degrees F and above to facilitate handling.

E. Keep solvents away from open flame or excessive heat.

F. Do not store modified membranes at ambient temperatures below 20 degrees F.

1.08 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

1.09 CO-ORDINATION

A. Ensure continuity of the waterproofing membrane throughout the scope of this section.

B. Work shall be so scheduled as to provide a watertight seal at the end of each working day on the areas worked upon during the day.

1.10 SITE CONDITONS

A. Environmental Requirements
   1. No installation work shall be performed during rainy or inclement weather and on frost or wet covered surfaces.

B. Protection
   1. Provide adequate protection of materials and work of this section from damage by weather backfilling operations and other causes.
   2. Protect work of other trades from damage resulting from work of this section. Make good such damage at own expense to satisfaction of the consultant.
   3. Apply protection course as soon as possible after installation of membrane.

1.11 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cold-Applied Modified-Polymer Elastomeric Waterproofing:
   1. Carlisle Coatings & Waterproofing, Inc: www.carlisleccw.com/#sle.
   2. Henry Company; Henry CM100: www.henry.com/#sle.
   3. W.R. Meadows, Inc; HYDRALASTIC 836: www.wrmeadows.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WATERPROOFING APPLICATIONS

A. Cold-Applied Modified-Polymer Elastomeric Waterproofing:
   1. Location: Exterior side of all below grade walls including the following locations:.
      a. Below Grade Concrete Masonry Surfaces
   2. Cover with drainage panel.

2.03 FLUID APPLIED WATERPROOFING MATERIALS

A. Cold-Applied Modified-Polymer Elastomeric Waterproofing:
   1. Cured Thickness: 55 mils, 0.055 inch, minimum.
   2. Suitable for installation over below grade concrete and concrete masonry substrates.

B. Basis of Design: Primary waterproofing membrane shall be Henry CM100 Cold Applied Elastomeric Membrane manufactured by Henry, a moisture cure, solvent free elastomeric waterproofing compound having the following characteristics:
   1. Conforms to ASTM C 836,
      a. Solvent content: 0%,
      b. Non Flammable, Flash point > 450 F,
      c. Elongation: >500%,
      d. V.O.C < 40 grams/ Liter,
      e. Can be applied to “green” concrete.

C. Fabric Reinforcement - Shall be Polyester Fabric with a minimum thickness of 8 mils and:

1. Grab Tensile Strength (ASTM 5034):
    a. MD: 25 lbs/in
    b. CD: 13 lbs./in
2. Trapezoid Tear (ASTM D1117):
    a. MD: 3 lbs
    b. CD: 6 lbs.
3. Mullen Burst: 17 psi

D. Flashing and Crack Treatment Membrane - Shall be 990-25 Elastomeric flashing sheet as supplied by Henry, a butyl/EPDM type, elastomeric membrane having a thickness of 47 mils.

E. Termination Sealant shall be HE925 BES Sealant manufactured by Henry; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
1. Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
2. Complies with Fed. Spec. TT-S-00230C, Type II, Class A,
3. Complies with ASTM C 920, Type S, Grade NS, Class 25,
4. Elongation: 450 – 550%,
5. Remains flexible with aging,
6. Seals construction joints up to 1 inch wide.

F. Prefabricated Drainage Board: Drainage board shall be two part prefabricated geocomposite drainage board consisting of a formed polystyrene or PVC core covered on one side with a woven or non-woven polypropylene filter fabric supplied by Henry:
1. Henry DB 520: For vertical installations requiring high compressive strength and high flow capacity with additional film attached to back side of membrane.

G. Termination bars shall be continuous aluminum, stainless steel or galvanized metal, 1/8" x 1" in size and shall be pre-drilled for non-corrosive screw attachment on a maximum of 8” centers.

2.04 ACCESSORIES

A. Protection Board Over Drainage Board: Rigid insulation specified in Section 07 2100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

D. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. New concrete should be cured for a minimum of 3 days and must be dry before waterproofing membranes are applied.

D. Remove curing compounds or any foreign matter detrimental to the adhesion of the primary waterproofing membrane or membrane flashings.

E. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

F. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

G. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

3.03 INSTALLATION - GENERAL

A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.

B. Crack Treatment:
   1. Seal cracks and joints up to 1/8 inch in width with a 12 inch wide by 55 mil thick coating of the primary membrane and a 6 inch wide strip of fabric reinforcement centered over the joint.
   2. Seal cracks and joints up to 1/4 inch in width with a 12 inch wide by 55 mil thick coating of the primary membrane and a 6 inch wide strip of elastomeric crack treatment membrane centered over joint.

C. Membrane Flashing At Protrusions:
   1. At mechanical pipe penetrations provide elastomeric flashing sheet set into a 55 mil thick coating of primary membrane. Overcoat and seal with membrane. Install clamps as required.

D. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - SINGLE COAT COLD APPLIED ELASTOMERIC MEMBRANE APPLICATION

A. Application of Single Coat Vertical Layer:
   1. Ensure substrates are ready to receive primary waterproofing membrane.
   2. Apply membrane by squeegee, roller or trowel ensuring full bond of membrane to substrate.
   3. Apply single coat layer of primary membrane evenly to a minimum thickness of 55 mils to form a continuous monolithic coating over vertical surfaces including previously reinforced areas.

3.05 INSTALLATION OF FOUNDATION DRAINAGE BOARD (VERTICAL)

A. Align and hang drainage board up to foundation wall, position bottom edge of drainage board to be in moderate contact with weeping tile system.

B. Secure drainage board to foundation wall with specified nails and washers spaced 16 inches o/c horizontally. Install minimum of 2 rows staggered and spaced 6 inches apart and min 6 inches from top edge.

C. Align and install specified termination strip along top edge with nails spaced 12 inches o/c and seal with termination sealant.

D. Overlap end laps, pull back loose fabric to expose drain core and position core of second panel over the first panel. Bend drain board to create inside corners and cut board to create outside corners, provide 3 inches of extra fabric to wrap corner.

E. Stagger or offset joints of drain board sheets. Place all subsequent sheets in an overlapping single fashion.

F. Backfill bottom edge in conjunction with weeping tile system.

3.06 CLEAN-UP

A. Promptly as the work proceeds and on completion, clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing work.

B. Clean soiled surfaces, spatters, and damage caused by work of this Section.

END OF SECTION 07 1400

SECTION 07 1713

BENTONITE PANEL WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bentonite clay waterproofing panels and accessories.

1.02 REFERENCE STANDARDS

A. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.

C. Manufacturer's Installation Instructions: Indicate special preparation of substrate, panel attachment methods, and perimeter conditions requiring special attention.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Maintain bentonite products dry. Protect with waterproof cover.

1.05 FIELD CONDITIONS

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bentonite Panel Waterproofing:
   1. AVM Industries, Inc; Aussie Clay 590: www.avmindustries.com/#sle.
   2. Carlisle Coatings and Waterproofing, Inc; CCW MiraCLAY: www.carlisleccw.com/#sle.
   3. CETCO, a division of Minerals Technologies Inc; SWELLTITE: www.mineralstech.com/#sle.

2.02 MATERIALS

A. Bentonite: Granulated pure, dry, bentonite clay comprised of 90 percent minimum sodium montmorillonite; 90 percent minimum passing No. 20 mesh sieve and 10 percent maximum passing No. 200 mesh sieve.

B. Three-Ply Panels: Triple corrugated core, smooth faced Kraft paper panels, center core filled with self expanding bentonite clay granules, outer layers placed at right angles to core layer.

2.03 ACCESSORIES

A. Fasteners: Galvanized nails.

B. Adhesive: Manufacturer's recommended type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are smooth and durable; free of matter detrimental to application of waterproofing system.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

B. Remove concrete fins, projections, and form ties.

C. Fill holes, cracks, honeycombs, and voids with bentonite gel seal, at least 1/8 inch thick, extending 3 inches, minimum, beyond defect.

3.03 INSTALLATION - GENERAL

A. Install panels in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Cut panels parallel to corrugations to prevent bentonite loss.

C. Seal construction joints with joint seal.

3.04 INSTALLATION - VERTICAL SURFACES

A. Install three-ply panels with masonry nails, starting at base of foundation.

B. Fold panels around corners with corrugations vertical, and install unfolded panels with corrugations horizontal.

C. Lap adjoining panels 1-1/2 inches.

D. Stagger vertical joints at mid-panel on succeeding courses.

E. Stagger vertical joints minimum 16 inches on succeeding courses.

F. Install one extra layer of panels at external corners.

G. Place joint packing continuous along junction of wall and footing; secure properly to prevent movement.

3.05 INSTALLATION - BELOW SLABS UNDER HYDROSTATIC CONDITIONS

A. Install polyethylene sheet over subgrade; lap joints 4 inches.

B. Lay single-ply panels in slab form, and align panels with edge of slab; do not lay panels over pile caps or footings supporting slab edges, and stagger joints of adjoining panel rows.

C. Lap joints 1-1/2 inch, minimum, and secure laps to prevent displacement.

D. Extend panels up vertical surfaces at least 12 inches and to overlap vertically applied bentonite panels.

E. Install joint seal in 1 inch high beads around penetrations through panels and 1/2 inch high beads around chair legs not placed on pads; cover beads with polyethylene sheet collars, cut to size.

F. Lay joint seal continuously along and around protrusions, penetrations, and at abutting walls; secure to prevent movement.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered waterproofing.

B. Cover installed waterproofing with temporary polyethylene sheeting; remove sheeting just before backfilling begins.

END OF SECTION 07 1713

SECTION 07 1900

WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior, masonry and concrete surfaces.

B. Pressure washing.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

1.03 REFERENCE STANDARDS

A. RILEM Tube Test to assess water absorption properties of walls and other substrates: 1980 report, “Tentative Recommendations: Recommended Tests to Measure the Deterioration of Stone and to Assess the Effectiveness of Treatment Methods,” by RILEM Technical Commission 25-PEM.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and Owner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installer's Qualification Statement.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 PERFORMANCE REQUIREMENTS

A. Performance Requirements:
   1. No change in surface texture, no blotchy appearance
   2. ASTM C140 “Sampling and Testing of Concrete Masonry Units, Absorption” - 24 hour submersion test:
      a. 99.4 percent reduction in water absorption.
   3. ASTM C642 "Specific Gravity, Absorption and Voids in Hardened Concrete" - 24 hour immersion:
      a. 97.5 percent effective.
   4. ASTM D1653 "Moisture Vapor Permeability of Organic Coatings":
      a. 68 g/sq ft/24 hours - 97 percent breathability.
   5. ASTM E514 “Water Permeance of Masonry.”
      a. 100 percent reduction in leakage rate over the control wall.
      b. Control wall must have a leakage rate of at least 6.0 liters/hours.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience and approved by manufacturer

C. Test Application: Apply a finish sample for each type of water repellent and substrate required. Duplicate finish of approved sample. Test area for RILEM uptake test(s) can serve as finish samples.
   1. Locate each test application as directed by Architect.
   2. Size: 9 sq. ft. minimum.
   3. Final approval by Architect of water-repellent application will be from test applications.
   4. Conduct RILEM test(s) to comply with requirements specified in Field Quality Control Article.

1.08 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.

B. Prepare representative surface 36 by 36 inches in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

C. Verify that water repellent will effectively repel moisture from surface, and will produce no surface stains.

D. Conduct RILEM Tube tests to determine water absorption or penetration.

1.09 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

C. Do not apply water repellents when wind velocity is higher than 10 mph.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide ten year manufacturer warranty for water repellency.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane Water Repellents:
   1. Basis of Design: Evonik Industries; www.protectosil.com/protectosil
   2. Other Acceptable Water Repellent manufacturers:
      a. Tnemec Company, Inc: www.tnemec.com.
      b. Master Builders Solutions, www.master-builders-solutions.com/
      c. PROSOCO, Inc.: www.prosoco.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
   2. Maintains dry appearance when wetted.
   3. Silane that reacts chemically with concrete and masonry.
      a. Basis of Design: Evonik Protectosil CHEM-TRETE BSM 400
      b. Other Acceptable Manufacturers:
         1) Master Builders Solutions, MasterProtect H 1000
         2) PROSOCO, Inc; Consolideck SL100 Water Repellent, with VOC of 400 g/L or less: www.prosoco.com/#sle.
         3) Tnemec Inc; Dur A Pell 100: www.tnemec.com/#sle.
         4) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.

D. Pressure wash surfaces to be coated.

E. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Apply number of coats recommended by manufacturer at their coverage rates.

D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

3.04 FIELD QUALITY CONTROL

A. Test Area: Before any water repellent application, perform the following field evaluation.
   1. Prepare a three foot by three foot area to be sprayed with the water repellent where directed by the Architect. Apply the water repellent at a rate of square foot per gallon as recommended by manufacturer to meet warranty requirements.
   2. After allowing five days for the sample to cure, run a RILEM uptake test on the treated area. Place one tube on the masonry and one tube on a mortar joint. Contact Architect at least one week prior to the application of the water repellent and the test.
   3. Repeat the test area procedure prior to application of graffiti-resistant coating.

B. Coverage Spray Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.
   1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
   2. After surfaces have adequately dried, recoat surfaces that show water absorption.
   3. Run random RILEM tests on each elevation of structure.

C. Manufacturer's Field Services: Furnish written certification that surface preparation method and final condition has manufacturer's approval and comply with warranty.
   1. Test Area: Furnish results of test area absorption on each type of substrate. Test results shall determine application rate.

3.05 DISPOSAL

A. Contain and neutralize excess water repellent to Department of Environmental Quality standards.

B. Dispose of neutralized excess repellent properly. Do not discharge into Sanitary Sewer or Storm Sewer Systems.

3.06 SCHEDULE

A. Apply to all exposed vertical surfaces of Unit Masonry and Brick Masonry Veneer.

B. Apply Water Repellent to vertical surfaces of all other exterior Concrete Masonry and exterior Concrete.

END OF SECTION 07 1900

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rigid and semi-rigid board insulation at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, and exterior wall behind masonry veneer and metal panel wall finish.

B. Batt insulation and vapor retarder in exterior wall construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 07 4113 - Metal Roof Panels: Insulation below metal roofing.

C. Section 07 5400 - Thermoplastic Membrane Roofing: Insulation specified as part of roofing system.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2020.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

H. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

1.05 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

C. Insulation Inside Masonry Cavity Walls: Mineral Fiber board.

D. Insulation Over Metal Stud Framed Walls, Continuous: Mineral Fiber board.

E. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.

F. Insulation Over Roof Deck: Polyisocyanurate board.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
   4. Board Size: 48 x 96 inch.
   5. Board Thickness: 2 inches or as required to achieve required R-value.
   6. Board Edges: Square.
   7. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
   8. R-Value per Inch: 5 per inch of thickness maintained over the life of the product in use.
   9. Compressive Resistance: 15 psi.
   10. Board Density: 1.3 lb/cu ft.
   11. Products:
      a. Dow Chemical Company; Styrofoam Square Edge: www.dow.com.
      b. Kingspan Insulation LLC; GreenGuard XPS TYPE IV 25 PSI: www.trustgreenguard.com.
      c. Owens Corning Corporation: www.ocbuildingspec.com/sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Polyisocyanurate (ISO) Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of core foam.
         1) Class 2 - Glass fiber reinforced or non-reinforced core foam.
         2) Compressive Strength: 16 psi, minimum.
         3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0, minimum, at 75 degrees F.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Board Size: 48 inch by 96 inch.
   5. Board Thickness: As required to achieve thicknesses indicated on Drawings.
   6. Board Edges: Square.
   7. Products:
      a. Atlas Wall CI Board, division of Atlas Roofing Corporation; EnergyShield: www.atlasroofing.com.
      b. Dow Chemical Company: www.dow.com/sle.
      c. GAF: www.gaf.com/sle.
      d. Rmax Insulation Products: www.rmaxinc.com
   8. Substitutions: See Section 01 6000 - Product Requirements.

2.03 FIBERBOARD INSULATION MATERIALS

A. Mineral Fiberboard Insulation: Rigid or semi-rigid mineral fiber, ASTM C612 or ASTM C553; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Board Size: 16 by 48 inches, or as required to fit tightly between supports.
   3. Board Thickness: 2 inches, or as required to achieve thicknesses indicated on Drawings.
   4. Thermal Resistance: R-value of 4.3 per inch, minimum, at 75 degrees F, minimum, when tested according to ASTM C518.
   5. Products:

a. ROCKWOOL (ROXUL, Inc); CAVITYROCK: www.rockwool.com/#sle.
b. Thermafiber, Inc; RainBarrier CI High Compressive (80): www.thermafiber.com.
c. Substitutions: See Section 01 6000 - Product Requirements.

6. Extent of Work: As continuous exterior insulation at all exterior walls.

2.04 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
4. Formaldehyde Content: Zero.
5. Facing: Aluminum foil, flame spread 25 rated; one side.
6. Products:
a. CertainTeed Corporation: www.certainteed.com/#sle.
b. Johns Manville: www.jm.com/#sle.
c. Knauf Insulation GmbH: www.knaufinsulation.us.
d. Owens Corning Corp: www.owenscorning.com.
7. Substitutions: See Section 01 6000 - Product Requirements.
8. Extent of Work:
a. In cavity of cold-formed steel stud exterior walls.
b. R-value: R-19, minimum.

2.05 INSULATION VAPOR RETARDERS

A. Batt Insulation Vapor Retarder: Polyimide film vapor retarder that changes permeance with change in humidity; Certainteed MemBrain, or approved.
1. Vapor Retarder Class: Class II.
2. Water Vapor Permeance:
a. ASTM E 96, dry cup method: 1.0 perms (57ng/Pa*s*m2) or less.
b. ASTM E 96, wet cup method: 10.0 perms (1144ng/Pa*s*m2) or greater.
3. Fire Hazard Classification: ASTM E 84:
a. Maximum Flame Spread Index: 20.
b. Maximum Smoke Developed Index: 55.
4. Extent: Over thermal batt insulation at interior side of all exterior walls.
5. Manufacturers:
a. Certainteed Corporation: www.certainteed.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 FOAM SEALANT

A. Provide one of the following:
1. One-component, minimally expanding, low pressure-build, polyurethane foam sealant.
a. Locations of Use: At perimeter window and door shim spaces and crevices in exterior wall and roof.
b. Products: Great Stuff Pro.
1) Substitutions: See Section 01 60 00 - Product Requirements.
2. Closed cell, medium density spray applied polyurethane foam insulation and air barrier.
a. Locations of Use: At perimeter window and door shim spaces and crevices in exterior wall and roof.
b. Products: BASF Walltite ECO v.2: www.walltite.com.
1) Substitutions: See Section 01 60 00 - Product Requirements.

B. Foam insulation at voids or cavities in exterior wall or roof:
1. Closed cell, medium density spray applied polyurethane foam insulation and air barrier.
a. Locations of Use: At voids and crevices in exterior wall and roof.
b. Products: BASF Walltite ECO v.2: www.walltite.com.

1) Substitutions: See Section 01 60 00 - Product Requirements.

2.07 ACCESSORIES

A. Tape: Polyethylene self-adhering type, mesh reinforced, 2 inch wide, compatible with vapor retarder.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Apply adhesive to back of boards:
   1. Three continuous beads per board length.
   2. Full bed 1/8 inch thick.

B. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.
   1. Butt edges and ends tightly to adjacent boards and protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Install vapor retarder in continuous sheets over the inside face of all exterior wall surfaces and at bottom of batt ceiling insulation. Lap and seal sheet retarder joints over framing member face.

F. Tape seal tears or cuts in vapor retarder.

G. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

3.06 PROTECTION

A. Do not permit installed insulation or vapor barriers to be damaged prior to its concealment.

END OF SECTION 07 2100

SECTION 07 2500

WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-resistive barriers.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

C. Building envelope pre-installation meeting and mock up requirements.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

C. Section 04 2000 - Unit Masonry: Concrete masonry unit substrate at Gymnasium walls.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

E. Section 07 9200 - Joint Sealants: Sealing building expansion joints.

F. Section 09 2116 - Gypsum Board Assemblies: Gpysum sheathing substrate panels.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2018.

B. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers; 2015.

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016.

D. ASTM D779 - Standard Test Method for Determining the Water Vapor Resistance of Sheet Materials in Contact with Liquid Water by the Dry Indicator Method; 2016.

E. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

H. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

I. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021.

J. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

K. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2019).

L. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017.

M. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 2015.

N. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. Obtain weather barrier system and auxiliary materials including adhesive/primer, air barrier, flashings, and sealants from a single Manufacturer regularly engaged in the manufacturing and supply of the specified products.
   2. Verify product compliance with federal, state, and local regulations.

B. Installer Qualifications:
   1. Company with minimum 5 years of documented experience installing similar weather barrier systems.
   2. Perform Work in accordance with the Manufacturer’s published literature and as specified in this Section.
   3. Maintain one (1) copy of the Manufacturer’s installation instructions on site.
   4. At all times during the execution of the Work allow access to site by the Manufacturer representative.

1.07 PRE-INSTALLATION MEETING

A. Hold a pre-installation conference, one week prior to start of weather barrier installation. Attendees shall include General Contractor, Architect, Weather Barrier Installer, Sheet Metal Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representative.

B. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.08 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up.
   1. See Section 01 4000 - Quality Requirements for additional requirements.

B. Install weather barrier and accessories in a mock-up to be reviewed by the owner, architect, and contractor prior to the installation of the systems listed. Mock-up may not remain as part of the work.

C. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

1.09 WARRANTY

A. Provide manufacturer's standard 10 year material warranty for air barrier membrane materials, sealant, and flashing membranes.

1.10 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

B. Do not perform Work during rain or inclement weather.

C. Do not perform Work on frost covered substrates or surfaces that are wet to touch.

1.11 WARRANTY

A. Manufacturer's Single Source Warranty:
   1. Assembly Warranty:
      a. Manufacturer must warrant the assembly against product defect for a period of twelve (12) years from the date of substantial completion.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Air Barrier:
   1. On outside surface of sheathing of exterior walls use air barrier sheet, self-adhered type.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Sheet-Applied, Vapor Permeable Water Resistive Air Barrier:
   1. Self-adhered vapor permeable, water resistive air barrier consisting of a reinforced, modified polyolefin tri-laminate film surface and permeable adhesive with split-back poly-release film; having the following typical physical properties:
      a. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
      b. Water Vapor Permeance: 29 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
      c. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).
      d. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
      e. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
      f. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC38.
      g. Nail Sealability (ASTM D1970): Pass
      h. Dry Tensile Strength (ASTM D882):
         1) 41 lbf /182N MD
         2) 29 lbf /129N CD
      i. Manufacturers:
         1) Basis of Design: Henry Company; Blueskin VP160: www.henry.com.
         2) Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Sealants, Primers, Tapes, and Accessories for sealing Weather Barrier and sealing Weather Barrier to adjacent substrates: Compatible with specified Sheet-applied weather barrier and as recommended by Weather Barrier manufacturer for project conditions.

B. Opening flashings, sill flashings, through-wall flashings, and transition membranes: Type compatible with air barrier material and part of manufacturer's approved assembly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

C. Continuous substrate:
   1. Existing substrate must be continuous and secured prior to application of air barrier.

2. Securely fasten sheathing panels and install flush to ensure a continuous substrate in accordance with Air Barrier Manufacturer’s installation guide and as specified in this Section.
3. Fastener penetrations must be set flush with sheathing and fastened into solid backing.
4. Refer to Air Barrier Manufacturer’s details.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

D. Self-Adhered Sheets:
1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle-fashion to shed water and seal laps airtight.
3. Upon placement of sheets, firmly press onto substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.
5. At expansion joints, provide transition to joint assemblies approved by sheet manufacturer.
6. Seal membrane terminations, heads of mechanical fasteners, around penetrations, piping, electrical and other apparatus extending through the water resistive aire barrier

E. Coatings:
1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
2. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.

F. Openings and Penetrations in Exterior Weather Barriers:
1. Install assembly components as indicated on drawings and according to sheet manufacturer's written recommendations.
2. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

G. Detailing/Flashing:
1. Complete detailing and flashing installations per Air Barrier Manufacturer’s installation guide, details, and this specification.
2. Refer to Air Barrier Manufacturer details for further clarification and installation procedures including, but not limited to, the following:
    a. Inside corners
    b. Outside corners
    c. Pipe penetrations
    d. Shelf angles
    e. Wall to foundation transitions
    f. Reverse laps
    g. Construction joints
    h. Rainscreen furring
    i. Masonry veneer ties

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Owner’s Inspection and Testing: Cooperate with Owner’s testing agency.
1. Allow access to work areas and staging.
2. Notify Owner’s testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.

3. Do not cover work of this section until testing and inspection is accepted.

C. Take digital photographs of each portion of the installation prior to covering up.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 07 2500

SECTION 07 4113

METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated metal roof panel system of preformed steel panels.

B. Metal roof panel system of preformed steel panels.

C. Metal panels for soffits with related flashings and components.

D. Snow and ice retention system.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Roof framing and purlins.

B. Section 07 2100 - Thermal Insulation: Rigid roof insulation.

C. Section 07 4213 - Metal Wall Panels: Preformed wall panels.

D. Section 07 9005 - Joint Sealers: Field-installed sealants.

E. Section 09 2116 - Gypsum Board Assemblies: Gypsum substrate board

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2019.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

F. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2017).

G. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 2011 (Reapproved 2018).

H. ASTM E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems; 2016.

I. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.
   2. Include structural analysis signed and sealed by qualified structural engineer, indicating conformance of roofing system to specified loading conditions, with attachment schedule specific to project.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
   1. Include typical panel joint in sample.
   2. Include typical fastening detail.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least 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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer and installer of Metal Roof Panels specified in Section 07 4113 must be the same as the manufacturer and installer of Metal Wall Panels specified in Section 07 4213.

B. Metal Roof Panels:
   1. Basis of Design: Morzip by Morin; www.kingspan.com
   2. AEP SPAN; www.aep-span.com.
   3. Fabral: www.fabral.com/#sle.
   4. Architectural Metal Solutions, AMS Armor Lock: www.ams.wa.com
   5. Metal Sales Manufacturing Corporation: www.metalsales.us.com.
   6. Taylor Metal Products: taylormetal.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, bearing plates, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
      a. Dead Loads: Weight of roofing system, and roof-mounted components where indicated.
      b. Live Loads: As required by ASCE 7.
   2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
   3. Wind Uplift: Class 90 wind uplift resistance of UL 580.

4. Air Infiltration: Maximum 0.06 cfm/sq ft at air pressure differential of 6.24 lbf/sq ft, when tested according to ASTM E1680.
5. Water Penetration: No water penetration when tested in accordance with procedures and recommended test pressures of ASTM E1646; perform test immediately following air infiltration test.
6. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.03 METAL ROOF PANELS

A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.
      b. Steel Thickness: Minimum 22 gauge, 0.028 inch.
   2. Profile: Standing seam, with minimum 1-1/2-inch seam height; concealed fastener system for field seaming with special tool.
   3. Texture: Smooth, with intermediate ribs for added stiffness.
   4. Length: Full length of roof slope, without lapped horizontal joints.
   5. Width: Maximum panel coverage of 18 inches.

2.04 METAL SOFFIT PANELS

A. Design is based on Lifetime Soffit, manufactured by Taylor Metal Products.

B. Soffit Panels: Factory-formed panels with factory applied-finish.
   1. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.

C. Profile: Double V-Groove (flat with two, evenly-spaced pencil ribs, no reveal).

D. Dimensions:
   1. Nominal exposed width: 12 inches
   2. Depth: 1 inch

E. Base Metal Material: Steel, conforming to ASTM A792 Zincalume, minimum yield 40,000psi.

F. Steel Thickness: 24 gage.

G. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.

2.05 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.
   1. Anchor clips shall be tested to establish that the clips will have 75% of the material thickness remaining after 100,000 cycles of the full range of motion.

B. Bearing Plates: Approximately 4 inch by 6 inch, Zincalume coated steel bearing plates at each clip for installation over compressible substrates.

C. Fasteners: Self-drilling galvanized or stainless steel screws engineered to meet performance requirements.

2.06 THERMAL INSULATION

A. Rigid insulation board as specified in section 07 2100 Thermal Insulation.

2.07 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat aluminum coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF)

resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss to match sample.

B. Colors: As shown on Drawings.

C. Underside finish: Manufacturer's standard off-white enamel.

2.08 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

D. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M, with strippable release film and top surface of woven polypropylene sheet.
   1. Sheet Thickness: 40 mil, 0.040 inch minimum total thickness.
   2. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M, Desiccant Method A.
   3. Products:
      a. Henry Company; Blueskin PE200HT: www.henry.com.
      b. Polyglass USA, Inc; Polystick MTS Self-Adhered High Temperature Roof Underlayment: www.polyglass.us.
      c. Substitutions: See Section 01 6000 - Product Requirements.

E. Vapor Retarder: Material approved by roof manufacturer; compatible with roofing and insulation materials.
   1. Self-adhered SBS modified bitumen vapor retarder/air barrier/temporary roofing membrane, 31 mils thick, with tri-laminated woven polyethylene facer that can accept approved urethane adhesives for insulation attachment.
      a. Sika SA 31 (Basis of Design) with primer recommended by manufacturer.
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Deck Sheathing:
   1. Material: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
   2. Thickness: 1/2 inch, fire-resistant.
   3. Products:
      a. Georgia-Pacific; DensDeck: www.densdeck.com.
      b. National Gypsum Company; DEXcell FA Glass Mat Roof Board: www.nationalgypsum.com.
      c. USG Corporation; Securock Ultralight Glass-Mat Roof Board: www.usg.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

G. Snow and Ice Retention System
   1. Material: Aluminum or stainless steel.
   2. Type: Clamp to standing seam of roofing system without penetration of roofing.
   3. Components: Clamping device at each roof seam and continuous single rod anchored to clamping device.
   4. Operation: Able to retain snow and ice and prevent snow and ice from falling from roof.
      a. Available Products:
         1) S-5! Corporation SnoRail S-5-ASF and SnoRod; www.s-5.com.
         2) Substitutions: See Section 01 60 00 - Product Requirements.
   5. Extent: Provide at roof eaves above exterior balconies and above other exterior occupied areas and where indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Coordinate roofing work with provisions for weather barrier, slip sheet, roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

B. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.

C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

D. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.

1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. If required by metal roof manufacturer or underlayment manufacturer, install slip sheet over weather barrier before installing metal roof panels.

D. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.

3.04 CLEANING

A. At completion of each day’s work, sweep panels, flashings and gutters clean. Do not allow fasteners, cuttings, filings or scraps to accumulate.

B. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Replace damaged roof panels or accessories before date of Substantial Completion. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Architect’s or Owner’s representative.

END OF SECTION 07 4113

SECTION 07 4213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, soffit panels, and subgirt framing assembly, with insulation, related flashings, and accessory components.

B. Furring supporting Metal Wall Panels

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 05 4000 - Cold-Formed Metal Framing: Wall panel substrate.

C. Section 07 2100 - Thermal Insulation: Insulation behind metal panels.

D. Section 07 2500 - Weather Barriers: Water-resistive barrier under wall panels.

E. Section 07 9200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 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. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

1.04 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage, flashings, terminations.

1. Shop drawings must reflect architectural detailing and conditions shown on the drawings. Manufacturer's standard catalog-type details are not acceptable.

C. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches in size illustrating finish color, sheen, and texture.

D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer and installer of Metal Roof Panels specified in Section 07 4113 must be the same as the manufacturer and installer of Metal Wall Panels specified in Section 07 4213.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.06 PRE-INSTALLATION MEETING

A. Convene two weeks before starting work of this section.

B. Review preparation and installation procedures, special conditions of the project.

1.07 MOCK-UP

A. Integrated Exterior Mock-Ups: Construct integrated exterior mock-up as indicated on Drawings and as specified in Section 01 4000 - Quality Requirements.

1. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, exterior wall finish, and interior wall finish.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 20 year manufacturer warranty for degradation of panel finish including chalking and fading, peeling, cracking, and delamination.

C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer and installer of Metal Roof Panels specified in Section 07 4113 must be the same as the manufacturer and installer of Metal Wall Panels specified in Section 07 4213.

B. Basis of Design: Morin; Product Matrix 8.0; www.kingspan.com

C. Other Acceptable Manufacturers:
   1. Centria: www.centria.com.
   2. Fabral; www.fabral.com
   3. AEP Span; www.aepspan.com.
   4. Metal Sales Manufacturing Corporation: www.metalsales.us.com.
   5. Taylor Metal Products: taylormetal.com
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior wall panels and subgirt framing assembly.
   2. Delegated Design: Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Design Pressure: In accordance with applicable codes.
   4. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   5. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   6. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.
   7. Provide continuity of water-resistive barrier seal at building enclosure elements; see Section 07 2500.

B. Exterior Panels:
   1. Default Pattern:
      a. Profile: Vertical; style as indicated.
      b. Pattern: Smooth, 10 inch exposure, 2 inch reveal, similar to Morin Maxtix 8.0.
      c. Panel height: 1 1/2 inch
      d. Coverage: 12 inch net, locations where indicated on drawings.
      e. Side Seams: Double-interlocked, tight-fitting, standing seam.
      f. Material: Precoated steel sheet, minimum 24 gage thick minimum.
      g. Anchorage: Concealed fasteners and panel clip allowing thermal movement of panel.
   2. At elevator overhead exterior walls (MP-3):
      a. Design Intent: Match adjacent metal roof panels.
      b. Profile: Standing seam, with minimum 1-1/2-inch seam height; concealed fastener system for field seaming with special tool.
      c. Pattern: Same as roof panels.
      d. Width: Same as roof panels.

C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

D. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

E. Anchors: Galvanized steel.

2.03 WALL PANEL SUPPORT SYSTEM

A. Contractor responsible for delegated design of metal wall panel support system, alignment with cold-formed wall framing and integration with weather barrier and continuous thermal insulation systems. Qualities listed below are a minimum.

B. Zee Subgirts: Cold formed Z-shaped steel with the following minimum qualities:
   1. Material: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating.
   2. Standards: Comply with Steel Stud Manufacturer Association (SSMA).
   3. Depth of web: As indicated on drawings.
   4. Width of Leg: 2 inches min.
   5. Gage: 12 gage
   6. Shape: Z shape, unpunched web and flange.
   7. Fasteners: Self-drilling. Comply with AISA Specifications for Screw Connections
      a. Size: #8 SMS
      b. Galvanized or Stainless Steel
      c. Conform to SAE J78
   8. Install vertically, aligned with wall framing.

C. Furring:
   1. Hat Channel vented profile; to attach panel system to Steel Z Subgirts.
   2. Install horizontally at 24 inches on center.
   3. Legs of hat channel to be perforated allowing air movement and drainage.
   4. Finish: Galvanized steel.

D. Neoprene Tape:
   1. Adhesive backed tape able to create thermal break between weather barrier system and Zee furring.
   2. Size: 1/8 inch thick by 3 inches wide.
   3. Material: Neoprene foam tape compatible with weather barrier system.
   4. Extent: Apply continuously over weather barrier system behind Zee furring.
   5. Manufacturer: As recommended by manufacturer of weather barrier system.

E. Insect Protection:
   1. Perforated J Channel Rain Screen Trim, high back type. Size: 2" x 3/4 inches by 1/4 inch. Install at perimeter of rainscreen. Paint black before installation. Perforated J Channel by Menzies Metal Products, www.menzies-metal.com.
   2. Insect screen: 4 inch wide fiberglass mesh insect screen at open joints in rainscreen as needed to prevent entry of insects. Color: Black

F. Thermal Insulation: As specified in Section 07 2100.

2.04 MATERIALS

A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

B. Exterior Finish Coating: DuraTech 5000; Polyvinylidine Fluoride, full 70 percent Kynar 500/Hylar 5000, consisting of a baked-on 0.15-0.20 mil corrosion resistant primer and a baked-on 0.70-0.80 mil finish coat with a specular gloss of 8 to 15 when tested in accordance with ASTM D523 at 60 degrees.

C. Panel Back coating: Manufacturer's primer as specified above.

2.05 ACCESSORIES

A. Trims and Flashings: Material, metal thickness, and finish to match panels. Profiles indicated in Drawings.

B. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

C. Fasteners: Manufacturer's standard type to suit application; stainless steel.

D. Field Touch-up Paint: As recommended by panel manufacturer.

E. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION

A. Install hat channels at spacing recommended by wall panel manufacturer.

3.03 INSTALLATION

A. Install Metal Roof Panel seams aligned with Metal Wall Panel seams as indicated on drawings.

B. Install panels, trims, closures, and flashings on walls in accordance with manufacturer's instructions.

C. Comply with methods and recommendations of SMACNA Architectural Sheet Metal Manual for flashing configurations required.

D. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

E. Fasten panels to structural supports; aligned, level, and plumb.

F. Secure panels without warp or deflection.

G. Cutting and Fitting:
   1. Cut panels neat, square, and true with shearing action cutters. Torch or power saw cutting is prohibited.
   2. Openings 6 inches and larger: Shop fabricate and reinforce to maintain original load capacity.
   3. Openings less than 6 inches: Field cutting is acceptable.

H. Install with exposed fasteners. Align fasteners vertically and horizontally at a uniform spacing.

I. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

J. Installation of insect protection: Install edge trim and screen as needed to prevent entry of insects within rain screen cavity. Locate over hat channel furring and below metal siding.

3.04 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. Panels or flashings with finish damage exposing metal or with substrate damage shall be replaced.

D. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION 07 4213

SECTION 07 4233

EXTERIOR SOLID PHENOLIC RAINSCREEN PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior rainscreen wall panels.

B. Aluminum support furring.

C. Fasteners and accessories.

D. Referred to on drawings as Exterior Phenolic Panels

1.02 RELATED DOCUMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 07 2100 - Thermal Insulation; Insulation and Zee furring substrate

C. Section 07 2500 - Weather Barrier, Subgirts supporting siding panels.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Adjacent flashings

1.03 SYSTEM DESCRIPTION

A. Exterior Rainscreen Assembly: Solid phenolic core, fire-retardant, exterior grade rainscreen wall panels, aluminum substructure, attachment system components, air/vapor barrier membrane, continuous exterior insulation, and all accessories necessary for a complete rear-ventilated, weathertight exterior rainscreen wall system. Furnish fastenings and flashings as required to complete rainscreen system.

1.04 PERFORMANCE REQUIREMENTS

A. General Performance: Solid phenolic exterior rainscreen wall panel system, aluminum substructure, and attachment accessories shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design Engineering: Design solid phenolic exterior rainscreen wall panel system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Design shall be inclusive of aluminum support structure system and all attachment accessories.
2. Design shall be inclusive of solid phenolic exterior rainscreen wall panel manufacturing and shall conform to Manufacturer's recommended installation procedures.

C. Structural Performance: Provide solid phenolic exterior wall panel system capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated based on Manufacturer's most current testing standards:

1. Wind Loads: Provide exterior rainscreen wall panel system, including aluminum support structure, capable of withstanding wind loads calculated according to requirements of authorities having jurisdiction or as determined based on the following minimum design wind pressures, whichever are more stringent:
   a. Uniform pressure as indicated on Drawings.
   b. As determined by the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," "Analytical Procedure".

D. Deflection Limits: Aluminum support structure and exterior phenolic rainscreen panel system shall be designed in accordance with the Manufacturer's recommended maximum deflection when tested under positive and negative design wind gust loads and shall withstand wind gust loads with horizontal deflections no greater than the Manufacturer's allowable span.

E. Thermal Movements: Exterior solid phenolic rainscreen panel system shall allow for thermal movements from ambient air and surface temperature changes by preventing buckling, opening of joints, over-stressing of components, failure of connections and other detrimental effects. Base calculations on surface temperature changes of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg. F, ambient; 180 deg. F, material surfaces.

F. Aluminum Support System: Provide aluminum support system capable of the following:
   1. 1. Design and install aluminum support structure to accommodate expected construction tolerances and misalignment, deflection of building structural components, and openings in the building enclosure as designed.

G. Thermally Broken: Design system with separator material to minimize thermal conductivity between exterior rainscreen framing system and supporting wall framing.

1.05 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: For each type of product indicated. Include Manufacturer's written installation instructions, including recommendations for evaluating, preparing, and treating substrate, rainscreen panel technical data, material descriptions, and finishes and tested physical and performance properties.

C. Shop Drawings: Show fabrication and installation layouts of solid phenolic exterior rainscreen panel, details of aluminum support structure conditions, anchorages for aluminum support structure, attachment system for panels, allowances for thermal expansion, trim, flashings, closures, corners, and accessories as required, and all special job specific details.

D. Delegated-Design Submittal: For complete system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Submit submittals as "Deferred Submittals" in accordance with Section 01 30 00 - Administrative Requirements. Transmit a copy of each submittal indicating agency approval to the Architect for record

F. Samples: For each type of exposed finish required, prepared on samples of size and type indicated below for approval:
   1. Rainscreen Wall Panels: Minimum 4” x 4” including fasteners and other wall panel accessories as required.
   2. Aluminum Support Structure: 12” long including fasteners and other accessories. Submit samples demonstrating materials, colors, and fastener attachment type.

G. Installer Qualification Data: For Installer, provide certification signed by solid phenolic rainscreen panel Manufacturer certifying that Installer complies with requirements to perform the work specified in this Section.

H. Qualification Data: For professional engineer.

I. Engineering Design Certification: From solid phenolic rainscreen panel Manufacturer, provide certification of acceptance of final shop drawings and acceptance of qualifications for installer. Certification must be provided before the start of the Work.

J. Closeout Submittals: From solid phenolic panel rainscreen panel Manufacturer, provide the following:
   1. Operation and Maintenance Data: Operation and maintenance manuals including methods for maintaining installed products, replacing damaged panels, and precautions against cleaning materials and methods detrimental to finishes and performance.

K. Warranty: Sample of Manufacturer’s standard 10 year limited warranty for solid phenolic exterior rainscreen wall panel system. Warranty shall be inclusive of material and labor for removal and reinstallation.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in the installation of exterior rainscreen wall panel systems who has a minimum of 3 years installing products indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is recognized and approved by the manufacturer as suitable for the execution of the Work.

B. Fabricator Qualifications: A shop that employs skilled workers who custom fabricate solid phenolic or similar exterior rainscreen wall panel systems to those required for this Project and whose finished products have a record of successful in service performance and who is certified by the Manufacturer.

C. Source Limitations: Obtain solid phenolic rainscreen panels and all auxiliary materials from a single-source Manufacturer who has a minimum of 25 years experience in the manufacture of exterior rainscreen wall systems or an accessory Manufacturer who is certified by the solid phenolic rainscreen panel Manufacturer. Panels shall be be manufactured in accordance with ISO9001 and ISO14001.

1.07 MOCK-UP

A. Integrated Exterior Mock-Ups: Construct integrated exterior mock-up as indicated on Drawings and as specified in Section 01 40 00 - Quality Requirements.
   1. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, exterior wall finish, and interior wall finish.

B. Demonstrate selections made under approved submittals and typical joints, surface finish, texture, tolerances, attachments to building structure, methods of installation, connections to adjacent building enclosure materials, and standard and quality or workmanship.

C. Mock-Up Size: As indicated on the drawings.

D. Location: As directed.

E. Mock-up may not remain as part of the Work.

1.08 PREINSTALLATION CONFERENCE

A. Pre-Installation Conference: Conduct pre-installation conference at Project site prior to commencing construction of mock-up specified herein to verify Project requirements.
   1. Review solid phenolic rainscreen panel installation requirements including substrate surface preparation, environmental limitations, typical details and flashings, Manufacturer's recommended installation procedures, coordination with adjacent trades, testing and inspection procedures, protection and repair procedures.
   2. Ensure all sub-trades interfacing with or affected by the construction of the solid phenolic rainscreen panel system are present, including Architect, General Contractor, solid phenolic rainscreen panel Manufacturer, mock up and commissioning testing agencies, air barrier installer, exterior insulation installer, structural substrate installer, plumbing installer, window installer, electrical installer and any other installer whose work interfaces with or affects the solid phenolic rainscreen wall panels.

1.09 PROJECT CONDITIONS, STORAGE, AND HANDLING

A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of solid phenolic rainscreen wall panels to be performed according to Manufacturer's written installation instructions and warranty requirements.

B. Field Measurements: Verify actual panel measurements/openings by field measurement before fabrication to accommodate site tolerances and changes in construction.

C. Comply with Manufacturer's stated ordering, lead-time, and manufacturing requirements to avoid construction delays.

D. Deliver solid phenolic panel materials, aluminum support structure, and other manufactured accessory materials in Manufacturer's original, unopened, and undamaged containers with identification labels intact and visible. Package solid phenolic rainscreen panels for protection during transportation and handling. Comply with Manufacturer's and Distributor's written delivery and handling guidelines.

E. Store solid phenolic rainscreen panels horizontally, covered with suitable weathertight and ventilated covering to prevent exposure to UV light and to ensure dryness with positive slope for drainage. Do not store panels in contact with ground or with materials that might cause staining, damage, scratching, or other surface damage.

F. Phenolic panel installer shall notify the General Contractor or Construction Manager immediately upon discovery of any issues with the substrate. i.e improper framing, walls out of plumb, windows not properly aligned, etc. These issues shall be appropriately addressed prior to continuation of panel system installation.

G. Remove damage and waste panel material from site and legally dispose of according to authorities having jurisdiction.

1.10 WARRANTY

A. A. Submit Manufacturer's standard limited 10 year warranty covering defects in material.

PART 2 PRODUCTS

2.01 SOLID PHENOLIC EXTERIOR RAINSCREEN WALL PANELS

A. General: Subject to compliance requirements, provide solid phenolic rainscreen wall panels for exterior façade applications:
   1. Basis of Design: Fundermax Exterior F Quality as imported by Architects Surfaces LLC. 888-688-8892 www.architectssurfaces.com <http://www.architectssurfaces.com/>
   2. Alternate Products :
      a. Trespa Mateon, www.trespa.com
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Product Description:
   1. Rainscreen Material: Solid phenolic resin, fire-retardant exterior grade rainscreen panel.
   2. Rainscreen Panel Finish: Standard Colors, finish as selected by Architect from Manufacturer’s standard color range.
   3. Rainscreen Panel Core: Standard brown core.
   4. Rainscreen Panel Thickness: 0.39 inches (10 mm) unless otherwise indicated on drawings.
   5. Rainscreen Panel Standard Sizes: As indicated on drawings.
   6. Substructure : (Exposed Fastener Type) (Concealed Fastener Type) extruded aluminum
   7. profiles, clips, closures, and tees and indicated on the project drawings.

C. Physical Properties:
   1. Smoke Development Index: Less than 450 per ASTM E-84.
   2. Flame Spread Index: Less than 10 per ASTM E-84.
   3. NFPA268 Surface Ignition test, pass.
   4. Ignition Temperature; Greater than 650 degrees Fahrenheit above ambient, ASTM D1929
   5. When required by code, the assembly shall meet the performance requirements of NFPA 285. 10mm exposed fastener panels with assemblies listed in ICC ESR #3340 are acceptable as NFPA 285 compliant. Any variations must be approved by the local code official.
   6. Panels shall have UV and weather resistance performance with a grey scale rating minimum of 4-5 per ISO 4892-2, 4892-3.
   7. Panels shall be impact resistant per EN-ISO 178
   8. Panels shall be scratch resistant per EN-438-6
   9. Panels shall be FSC Certified.
   10. Panels shall be ICC AC92 compliant and have ICC Evaluation Services Report.
   11. Panels shall be hail impact resistant, 70mm (2 3/4”) ice ball at a velocity of 30 m/second (approx. 67 mph) with no breakage, discoloration or tearing. Tested per Austrian APBIC Standard, Association of Public Building Insurance Companies.

2.02 AUXILIARY MATERIALS

A. Aluminum Furring Support Structure: Extruded, finished, and color-matched for the type of use indicated on project Drawings.

B. Attachment Accessories: Of type, size, corrosion-resistance, holding-power and color-matched as required to suit attachment to aluminum support structure.

C. Insect Protection:

1. Perforated J Channel Rain Screen Trim, high back type. Size: 2 inch x 3/4 inches by 1/4 inch. Paint black before installation. Perforated J Channel by Menzies Metal Products, www.menzies-metal.com.
2. Insect screen: 4 inch wide fiberglass mesh insect screen at open joints in rain screen as needed to prevent entry of insects. Color: Black.

D. Louver Foundation & Soffit Vent, 8" Wide x 16" Long with screen. Model VS816 by FAMCO.

2.03 FABRICATION

A. General: Fabricate solid phenolic rainscreen wall panels and accessory materials in accordance with Manufacturer's written instructions and approved submittals, and at a fabrication facility trained and approved by Manufacturer. Comply with indicated profiles and within dimensional and structural requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances of structural substrate, aluminum support structure, solid phenolic rainscreen panel, and other conditions affecting performance.
1. Verify that substrate conditions, wall framing, and other structural panel support members and anchorages installed under other sections are acceptable for product installation and have been installed within acceptable tolerances in accordance with Manufacturer's written instructions.
2. Verify that air and weather resistant barrier has been installed over structural sheathing in accordance with air barrier Manufacturer's recommend installation instructions and terminated properly at openings to prevent air infiltration or water penetration.
3. Examine rough-in installation for components and systems adjacent to and penetrating into solid phenolic rainscreen panels to verify actual locations of penetrations relative to joint locations of panels prior to panel installation.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Aluminum Support Structure: Install clips, L-shapes, J-shapes, Z-shapes, hat channels, fillers, and other components in accordance with approved Shop Drawings and Manufacturer's recommended installation instructions.

B. Install aluminum support structure framing level and plumb and within tolerances of the completed system as approved and recommend by Manufacturer and in accordance with approved Shop Drawings.

C. Ensure air and water barrier is properly installed per air and water barrier Manufacturer's approved rainscreen wall panel installation instructions and is protected from UV light deterioration at panel open joint locations or is otherwise UV stable. Pay close attention to manufacturer's recommendations for treating penetrations in the membrane.

D. Notify General Contractor or Construction Manager immediately upon discovery of any tears, holes, or other damages to the membrane or barrier.

3.03 SOLID PHENOLIC RAINSCREEN PANEL INSTALLATION

A. Install solid phenolic rainscreen panels plumb and level and accurately spaced per Manufacturer's written installation instructions and in accordance with approved Shop Drawings.

B. Fasten solid phenolic rainscreen wall panels to aluminum support structure with fasteners approved for use with adjoining construction and in accordance with approved Shop Drawings for color matching and to confirm compliance with wind load and engineering design requirements.

C. Use exposed fasteners through the panel to the aluminum support structure. Arrange fasteners in a regular, orthagonal, alignment as indicated on shop drawings.

D. Erection Tolerances: Install aluminum support structure within the required installation tolerances as recommended by Manufacturer and in accordance with approved Shop Drawings.

E. Do not apply sealant to solid phenolic rainscreen panel joinery unless otherwise indicated on Drawings or in accordance with Manufacturer's recommended installation instructions.

3.04 CLEANING

A. Upon completion of solid phenolic rainscreen wall panel installation clean finished surfaces as recommended by panel Manufacturer prior to Owners' acceptance.

B. Legally dispose of all surplus materials off site.

END OF SECTION 07 4233

SECTION 07 5400

THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Vapor retarder.

D. Deck sheathing.

E. Cover boards.

F. Flashings.

G. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 05 3100 - Steel Decking: Product requirements for acoustical insulation for deck flutes, for placement by this section.

B. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.

1.03 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2020.

C. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2019.

D. FM (AG) - FM Approval Guide; current edition.

E. FM DS 1-28 - Wind Design; 2016.

F. NRCA (RM) - The NRCA Roofing Manual; 2019.

G. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene two weeks before starting work of this section.

1. Review special conditions of the project, preparation and installation procedures and coordinating and scheduling required with related work.
2. Minimum attendance: General Contractor Superintendent, Roofing Contractor Foreman, Roofing Manufacturer's Technical Representative, Sheet Metal Contractor's Foreman, Owner, Architect.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, fasteners, and accessories.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

D. Samples for Verification: Submit two samples 12 by 12 inches in size illustrating insulation and roof membrane.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in “Performance Requirements” Article and herein.

1. Written approval by membrane manufacturer for use and performance of membrane in this application, including that materials supplied for project comply with requirements of cited ASTM standards and Project Documents.

2. Submit evidence of compliance with performance requirements including relevant assembly numbers.
3. Certify that materials are free of asbestos.
4. Manufacturer’s Project Acceptance Document: Submit certification that manufacturer and installer will warrant roofing system for the specific site, design, details, and application indicated for this Project.

F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions, special procedures, and perimeter conditions requiring special attention.

G. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

H. Manufacturer's qualification statement.

I. Testing firm's qualification statement.

J. Specimen Warranty: For approval.

K. Warranty Documentation:
1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
2. Submit installer's certification that installation complies with warranty conditions for waterproof membrane.

1.06 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 the work of this section with at least five years of documented experience.

C. Source Quality Control:
1. Manufacturer’s Products: Obtain roofing materials from only one manufacturer. Provide materials that are not available from the manufacturer from sources that are recommended and approved by the manufacturer.
2. Materials shall be obtained only from manufacturers who will, if required, send a qualified technical representative to the project site for the purpose of advising the Contractor on the procedures and precautions for use of the specified materials.

D. Supervision:
1. Installer shall maintain a full-time supervisor/foreman for each major area of work, who is on job site during times that roofing work is in progress, who is experienced in installing roofing systems similar to type and scope required for this Project, and is not performing actual installation work.

E. Quality Standards:
1. Cited Standards and specified manufacturers’ catalogs, current at the date of bidding documents, unless otherwise specified, are incorporated herein by reference and govern the work. If conflict is discovered between referenced Standards or catalogs and the project specifications, request written clarification from the Owner and Architect/Engineer. Do not proceed with the work until receiving clarification.
2. Comply with recommendations of the latest edition of the following standards:
   a. SMACNA -”Architectural Sheet Metal Manual”
   b. NRCA “The NRCA Roofing Manual”
   c. Underwriters Laboratories (UL)
   d. American Standard Testing and Materials (ASTM)

F. Pre-installation Conference: Before installing roofing system, conduct conference at Project site to comply with requirements of Section 01 3000.
1. Meet with Owner, Installer, manufacturer’s technical representative, and installers whose work interfaces with or affects roofing including installers of roof accessories and other

adjoining work, and representatives of other entities directly concerned with performance of roofing work.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review base flashings, special roofing details, roof drainage, roof penetrations, mechanical equipment curbs, and condition of other construction that will affect roofing system.
4. Review requirements for inspections, testing, certifications, forecasted weather conditions, governing regulations, insurance requirements, and proposed installation procedures.
5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and attachment to structure.
6. Review loading limitations of deck during and after roofing.
7. Review governing regulations and requirements for insurance, certifications, and inspection and testing, if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.
10. Review field constructed mock-ups.
11. Record discussions of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
1. Warranty Term: 20 years.
2. For repair and replacement include costs of both material and labor in warranty.
3. Warranty should be from the manufacturer of the membrane, not the marketer.
4. Warranty should include the membrane, plates, fasteners, insulation, recover board, and other accessories specified in this Section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
1. Carlisle Roofing Systems, Inc; Sure-Weld TPO: www.carlisle-syntec.com/#sle.
2. Firestone Building Products, LLC: www.firestonebpco.com/#sle.
3. GAF: www.gaf.com/#sle.
4. Johns Manville: www.jm.com/#sle.
5. Versico Roofing Systems: www.versico.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Requirements:

C. Acceptable Insulation Types - Constant Thickness Application:

1. Minimum 2 layers of polyisocyanurate board.

D. Acceptable Insulation Types - Tapered Application:

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Basis of Design: Firestone 60 mil TPO Fully Adhered Roofing System.
   1. Roofing systems manufactured and provided by any of the approved manufacturer's noted above matching the product in the Basis of Design is acceptable. Others must be pre-approved during bidding through the substitution process.

B. Membrane Roofing Materials:
   1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
      a. Thickness: 60 mil, 0.060 inch, minimum.
   2. Sheet Width: Factory fabricated into largest sheets possible.
   3. Color: Gray.

C. Seaming Materials: As recommended by membrane manufacturer.

D. Vapor Retarder: Material approved by roof manufacturer; compatible with roofing and insulation materials.
   1. Self-adhered SBS modified bitumen vapor retarder/air barrier/temporary roofing membrane, 31 mils thick, with tri-laminated woven polyethylene facer that can accept approved urethane adhesives for insulation attachment.
      a. Sika SA 31 (Basis of Design) with primer recommended by manufacturer.
      b. Substitutions: See Section 01 6000 - Product Requirements.

E. Flexible Flashing Material: Same material as membrane.

2.04 DECK SHEATHING

A. Deck Sheathing: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
   1. Thickness: 1/2 inch, fire-resistant.
   2. Products:
      a. Georgia-Pacific; DensDeck: www.densdeck.com/#sle.
      b. National Gypsum Company; DEXcell FA Glass Mat Roof Board: www.nationalgypsum.com/#sle.
      c. USG Corporation; Securock Ultralight Glass-Mat Roof Board: www.usg.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 COVER BOARDS

A. Cover Board: High compressive strength polyisocyanurate (ISO) board insulation complying with ASTM C1289, and the following characteristics:
   1. Classification: Type II, Class 4 - Faced with coated or uncoated polymer-bonded glass fiber mat facers on both major surfaces of the core foam.
   2. Compressive Strength: Type II, Class 4; Grade 1, 80 psi.
   3. Board Size: 48 by 96 inches.
   4. Board Thickness: 1/4 inch.
   5. Thermal Resistance: R-value of 2.0, minimum, at 1/2 inch thick and 75 degrees F mean temperature.

2.06 INSULATION

A. Minimum insulation R-Value unless otherwise notes: R-30

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type II:
         1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
         2) Compressive Strength: Classes 1-2-3, Grade 1, 16 psi (110 kPa), minimum.

3) Thermal Resistance: LTTR R-value of at least 5.0 per inch. R-Value per inch must be maintained over the life of the product.

2. Board Size: 48 by 96 inches.
3. Board Thickness: ____ inch; use multiple layers of insulation board to achieve specified R-value or thickness, joints staggered.
4. Tapered Board: Slope as indicated; minimum thickness ____ inch; fabricate of fewest layers possible.
5. Board Edges: Square.
6. Products:
   a. Any manufactuer meeting specifications and approved by membrane manufacturer..

2.07 ACCESSORIES

A. Primers: Primers for the membrane roofing shall be as recommended and supplied by the membrane manufacturer.

B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

C. Cant and Edge Strips: Perlite board, compatible with roofing materials; cants formed to 45 degree angle.

D. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

E. Fasteners: Factory-coated steel fasteners and corrosion-resistant metal plates, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
   1. General
      a. Fasteners shall be as approved by manufacturer for substrates encountered including laboratory uplift resistance in accordance with Underwriters Laboratories (UL580). Tests for uplift resistance of roof assemblies.
      b. Provide all mechanical fasteners and related items such as washers and plates, galvanized after fabrication and coated with two coats of corrosion-resistant coating.
      c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      d. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
   2. Non-corrosive metal, compatible with material being fastened or anchored. Spacing as noted on Drawings.
   3. Metal to Metal: Metal fasteners, No. 3 point, 10 - 16 by 3/4 inch (minimum length) stainless steel or having an approved corrosion resistant coating and with an integral neoprene/steel sealing washer.
   4. Rivets: Solid rivets of same material as being connected.
   5. Expansion Inserts: Lead or nylon.

F. Membrane Faced (Coated) Metal Flashings: Manufacturer’s standard heat weld able membrane product fabricated of not less than 20 mils of same colored roofing membrane permanently bonded to commercial quality steel sheet, not less than 24 gauge, that has been hot-dipped galvanized according to ASTM A527, G90.
   1. For use only on conditions not visible from the ground.

G. Membrane Adhesive: As recommended by membrane manufacturer.

H. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

I. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

J. Sealants: As recommended by membrane manufacturer.

K. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Roofing membrane manufacturer's standard.

2. Size: Manufacturer's standard size.
3. Surface Color: White or Gray.
4. Location as indicated on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - METAL DECK

A. Install deck sheathing on metal deck:
1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
3. Tape joints.

3.03 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.04 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
1. Extend vapor retarder under cant strips and blocking to deck edge.
2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Attachment of Insulation:
1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and FM DS 1-28 Factory Mutual requirements.

C. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

E. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

F. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

H. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

I. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.

J. Do not install more insulation than can be covered with membrane in same day.

3.05 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate of ___ gallons per square foot. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. Mechanical Attachment: Install membrane and mechanical attachment devices in accordance with manufacturer's instructions.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and sumps and related flashings.

H. Install walk pads as indicated on Drawings.

3.06 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Upon completion of the installation, the manufacturer's representative shall make an inspection to ascertain that the roofing membrane system has been installed according to manufacturer's approved specifications and details. The inspection shall determine if any corrective work will be required before the warranty will be issued. Notify the architect 72 hours prior to manufacturer's representative visits.

3.07 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

C. Remove markings from finished surfaces.

D. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

E. Repair or replace defaced or damaged finishes caused by work of this section.

F. Prior to substantial completion broom clean entire roof surface to remove any and all accumulated dirt, construction debris, screws, nails, sheet metal snips, garbage, rags, buckets, tools, roofing scraps, etc. Assure all roof drains and scuppers are clean and free draining.

3.08 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 07 5400

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, exterior penetrations, and other items indicated in Schedule.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 04 2000 - Unit Masonry: Metal flashings embedded in masonry.

C. Section 04 2000 - Unit Masonry: Through-wall flashings in masonry.

D. Section 05 5000 - Metal Fabrications: Cold-rolled steel gutters, scuppers, downspouts.

E. Section 07 3113 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.

F. Section 07 4113 - Metal Roof Panels: Flashings associated with roofing system.

G. Section 07 4213 - Metal Wall Panels: Flashings associated with wall panel system

H. Section 07 5400 - Thermoplastic Membrane Roofing: Flashings associated with roofing system.

I. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

J. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

G. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

I. CDA A4050 - Copper in Architecture - Handbook; current edition.

J. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples 4 by 4 inch in size illustrating metal finish color.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented successful experience.

1.07 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized (Precoated) Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, (0.0239) inch thick base metal, shop pre-coated with silicone modified polyesterPVDF coating.
   1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As indicated on drawings.

B. Anodized Aluminum: ASTM B209/B209M; 20 gauge, 0.032 inch thick; clear anodized finish.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, minimum 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.03 GUTTER, DOWNSPOUT, AND DOWNSPOUT COVER FABRICATION

A. Gutters: SMACNA (ASMM), Rectangular profile.

B. Downspout Cover: As detailed on the Drawings.

C. Gutters and Downspouts: Sizes as indicated on the drawings.

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

E. Downspout Boots: Cast iron.

F. Seal metal joints.

2.04 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Underlayment: ASTM D226/D226M, organic roofing felt, Type I (No. 15).

C. Primer: Zinc chromate type.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Concealed Sealants: Non-curing butyl sealant.

F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

G. Plastic Cement: ASTM D4586/D4586M, Type I.

H. Solder: ASTM B32; Sn50 (50/50) type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

C. Verify that nailers and blocking are properly installed.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Comply with drawing details.

B. Install Work watertight, without waves, warps, buckles, tool marks, fastening stresses, distortion, or defects which impair strength of mar appearance.

C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Seal metal joints watertight.

G. Install planes and lines in true alignment. Allow for sheet metal expansion and contraction.

H. Gutters:
   1. Provide expansion joints midway between downspouts; provide end caps spaced 1/2 inch apart. Rivet and seal thimble flanges to gutter bottom.
   2. Cover expansion joint tops with loose-lock cover; extend cover over outer edge of gutter, and embed in sealant.
   3. Secure gutter to roof framing with straps spaced 24" o.c. max.
   4. Install gutters level.

I. Downspouts:
   1. Attach to wall with 1 1/2" wide straps as scheduled. Reinforce straps to allow standoff from walls for straight drop.
   2. Locate straps at downspout tops, bottom, horizontal joints, and 10 ft maximum centers.
   3. Secure straps to wall with fastener heads covered with strap-tabs.
   4. Except where otherwise shown on Drawings, install downspouts plumb; modify straps if necessary.
   5. Connect downspouts to downspout boots installed by others. Grout connection watertight.

J. Copings:
   1. Install copings with continuous cleat on the exterior side, fastened at 16 inches on center. Use exposed fasteners with neoprene washers through elongated holes on the roof side, at 24 inches on center.

3.04 SCHEDULE

A. Gutters: Precoated steel, 24 gage.

B. Downspout Covers: Precoated steel, 24 gage.

C. Gutter Supports and Straps: Match material, 14 gage.

D. Through Wall Scuppers: 26 gage stainless steel.

E. Through Wall Scupper Collection Boxes: 26 gage stainless steel.

F. Drip Edge Flashings: 24 gage stainless steel.

G. Drip Edge at Masonry Through-Wall Flashing: 24 gage stainless steel.

H. Coping, Cap, Parapet, and Ledge Flashings: 24 gage precoated steel, unless otherwise indicated.

I. Sill Flashings: 26 gage stainless steel.

J. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports: 24 gage galvanized steel, unless otherwise indicated.

K. Other flashings as shown on Drawings: As indicated.

END OF SECTION 07 6200

SECTION 07 7200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof hatches and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 7273 - Fall Arrest Roof Anchors

B. Section 07 4113 - Metal Roof Panels.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for product to be free from defects in material and workmanship.

PART 2 PRODUCTS

2.01 ROOF HATCHES AND VENTS

A. Roof Hatch Manufacturers:
   1. PS Access Solutions; Slidewise Roof Hatch: www.psdoors.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Hatches: Factory-assembled galvanized steel frame and cover, complete with operating and release hardware.
   1. Basis of Design: Slidewise Roof Hatch
   2. Style: Provide flat metal covers unless otherwise indicated.
   3. Track and Frame: Unitized track mounting frame. Hatch operates on four (4) aluminum rollers with double sealed stainless steel ball bearings.

4. Mounting: Provide frames and curbs suitable for mounting conditions as indicated on drawings.
5. Weatherseals: Compressible UV Resistant, EPDM bulb seals, full perimeter. Field replaceable.
6. Lock/Latch: Deadbolt, keyed exterior and keyed interior. Provide with Schlage cyliders, G keyway to match District standards.
7. Size: 36" x 36", or as indicated on drawings; sliding single leaf style.

C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
1. Material: Galvanized steel, 14 gauge, 0.0747 inch thick.
2. Finish: Factory prime paint.
3. Insulation: Manufacturer's standard; 2 inches rigid glass fiber, located on outside face of curb.
4. Curb Height: 18 inches from finished surface of roof deck, minimum.

D. Metal Covers: Flush, insulated, hollow metal construction.
1. Capable of supporting 40 psf live load.
2. Material: Galvanized steel; outer cover 14 gauge, 0.0747 inch thick, liner 22 gauge, 0.03 inch thick.
3. Finish: Factory prime paint.
4. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
5. Gasket: Neoprene, continuous around cover perimeter.

E. Hatch Railing System:
1. Provide a hatch rail system by hatch manufacturer, field assembled and installed per the manufacturer’s instructions.
2. Performance characteristics:
   a. Hatch rail system shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
   b. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two.
   c. UV and corrosion resistant construction.
   d. Self-closing gate shall be provided with hatch rail system.
3. Hardware: Mounting brackets shall be ¼” thick hot dip galvanized steel. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

B. Adjust hinges for smooth operation.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 07 7200

SECTION 07 7273

FALL ARREST ROOF ANCHORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof-mounted fall protection system including:
   1. Roof mounted fall arrest roof anchors.
   2. Horizontal lifelines

1.02 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Substrate for anchors.

1.03 REFERENCES

A. The work of this Section to conform to:
   1. Occupational Safety & Health Administration (U.S. Department of Labor)
      a. OSHA 1910.28, SubPart D (Walking-Working Surfaces)
      b. OSHA 1910.66, SubPart F (Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms).
      c. OSHA 1926.500, SubPart M (Fall Protection).
      d. Department of Labor Memorandum to Regional Administrators for Descent Control Devices.
   2. American National Standards Institute
      a. ANSI A39.1-1969 (Safety Requirements for Window Cleaning).
   3. American Society of Mechanical Engineers
      a. ASME A120.1-1996 (Safety Requirements for Powered Platforms for Building Maintenance).
      b. ASME Addenda A120.1a-1997 and A120.1b-1999.
   4. International Window Cleaner's Association
      a. IWCA I 14 (Window Cleaning Safety Standard).
   5. American Society for Testing and Materials
      a. ASTM D3963/D M-87 (Structural Specification for Epoxy Reinforcing Steel).
      b. ASTM A36 (Non exposed Structural Components).
      c. ASTM A123 (Standard Specification for Zinc Coating - Hot Dip Galvanizing - of Iron and Steel Products).
      d. ASTM Z325 (Bolts, Nuts and Washers).
   6. American Welding Society
      a. AWS D1.1 (Structural Welding Code)
   7. Aluminum Association
      a. AA 5AS-30 (Specifications for Aluminum Structures)

1.04 SYSTEM DESCRIPTION

A. Provide fall restraint and fall arrest system capable of withstanding loads and stresses within limits and under conditions specified in OSHA and other applicable safety codes. Provide fall protection anchors permanently attached to roof structure. Where indicated, provide cable lifeline system to allow continuous travel past intermediate anchors

B. Design Requirements: Anchors and accessories comprising system of following types:
   1. Roof anchors, spaced as indicated, for safety snap connection by individual workers capable of withstanding a 5,000 pound load or safety factor of 2 meeting the requirements of OSHA 1926.502(d)(8).
   2. Continuous stainless steel cable lifeline restrained by swaged terminations at anchor points, suitable for multiple safety snap connections along cable between anchors.
   3. Tensioning system with tension indicator.
   4. Pass-thru technology allowing workers cable shuttle to run freely pass intermediate anchors without the working having to disconnect / re-connect to the fall protection system.

C. Performance Requirements: System and components tested for resistance of following loads:

1. Fall Restraint: 4 persons simultaneously applied.
2. Fall Arrest: 2 persons.
3. Design fall protection anchors to resist at least 5,000 pound applied in any direction at a height of approximately 8 inches above top of roof deck or provide engineered system designed meeting the requirements of OSHA 1926.502(d)(8).

D. Co-ordinate work of this Section with roofing systems to provide continuous waterproof protection.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Manufacturer's descriptive literature for each product, including section or other type details.

C. Manufacturer's written installation instructions.

D. Shop drawings and samples in accordance with Section 01 30 00. Shop drawings to show roof layout indicating location and spacing of anchors, including dimensions, detail drawings of securement to structure, design details, and similar data. Drawings and calculations to bare stamp of Professional Engineer licensed in the State in which the project is located.

E. Operation and Maintenance Data: Upon completion of project, provide written instructions for maintenance of fall prevention safety devices, and Log Book for mandatory annual inspection.

F. Record Documents: Upon completion of project, provide Owner with roof plan showing layout of safety anchor system.

G. Delegated-Design Submittal: For fall arrest roof anchor system 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. Submit submittals as "Deferred Submittals" in accordance with Section 01 30 00 - Administrative Requirements. Transmit a copy of each submittal indicating agency approval to the Architect for record.

1.06 QUALITY ASSURANCE

A. Fall arrest roof anchors manufacturer to have minimum 5 years documented experience in the design and fabrication of fall protection systems.

B. Comply with all requirements of:
1. OSHA Standards; Comply with Occupational Safety and Health Administration Standards for the Construction Industry 29 CFR 1296.500 Subpart M (Fall Protection), with applicable State Administrative Code safety standards for Fall Restraint and Fall Arrest.
2. OSSC Oregon Structural Specialty Code - Uniform Building Code

1.07 COORDINATION

A. Review documentation of structural deck, reinforcements, and anchorages to receive fall protection anchors.

1.08 WARRANTY

A. Warrant products installed under this section of work to be free of leaks, condensation and defects in materials and/or manufacture for a period of 20 years when installed in accordance with the manufacturer's written instructions.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Guardian Fall Protection, 26609 79th Ave. S., Kent, WA 98032, Phone: 800-466-6385, ext. 113, Fax: 800-670-7892 www.guardianfall.com

B. Super Anchor Safety, 8522-216th Street SE, Woodinville, WA 98072. Commercial Roof Anchor. Phone 425-488-8868 www.superanchor.com.

C. Thaler Metal Industries, 1-800-387-7217, (Mississauga, Ontario, Canada) or 1-800-576-1200 (Niagara Falls, NY)

D. Pro-Bel Enterprises Limited, ·765 Westney Road South, Ajax, Ontario, Canada. L1S 6W1, (800) 461-0575 - U.S.A. Toll Free: www.pro-bel.ca

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MANUFACTURED UNITS

A. "Fixed Eye" Roof Anchors
   1. Materials:
      a. Steel Plates, Bars: ASTM A240 / A240M - 09a (Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications).
      b. Wire Rope: ASTM A 492 Standard Specification for Stainless Steel Rope Wire.
      c. Aluminum: ASTM B221 - 08 Standard Specifications for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. Manufactured Assemblies:
      a. Similar to Guardian CB Roof Anchors with Guardian CB/XS adapter cap allowing connection of XS pass thru components to be connected to Guardian CB roof anchors. Height of post to extend a minimum of 12 inches above surface of roofing. Size of base plate to suit conditions of use.
      b. Tensioner Set: Stainless Steel and Aluminum tensioning unit with turnbuckle and tension indicator.
      c. Intermediate supports: Intermediate straight and elbow units to attach to CB roof anchors with CB/XS adapter cap allowing cable to slide freely.
      d. Lifeline: Continuous 8 mm stainless steel cable as tested by fall protection device manufacturer to permit worker mobility and safety.
      e. Terminations: Swaged terminations to attach cable to end anchors. Cable clamps are not acceptable.
      f. Connectors: Locking runner providing secure attachment to cable at any location.
   3. Finish: Hot Dipped Galvanized.
   4. Extent:
      a. Single point anchors at Single-Ply Membrane Roofing area.
      b. Lifeline system at Metal Roofing area.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine framing and substrate and verify conditions comply with structural requirements for proper system performance.

B. Proceed with installation of roof anchors only after verifying conditions are satisfactory.

3.02 INSTALLATION

A. Roof Anchors
   1. Install anchors or equipment in accordance with manufacturer’s printed instructions, shop drawings, manufacturer's recommendations and as specified.
   2. Where necessary, provide protection against deterioration due to contact of dissimilar materials.
   3. Where bolting is used for fastening anchors, no fewer than two threads is to be exposed and the nut is to be positively locked by deforming threads, welding, pinning or equivalent method.
   4. Ensure work is inspected prior to application of roofing by the manufacturer's factory-trained representative.

B. Flashing
   1. Install roof support flashing in accordance with anchor manufacturer’s printed instructions, and coordinated with the roofing manufacturer and subcontractor.

3.03 ADJUSTING AND FINAL INSPECTION

A. Verify that all manufactured units have been installed in accordance with specifications and details, and will function as intended. Adjust any items where necessary to ensure proper operation.

B. Replace damaged or malfunctioning items.

C. Provide necessary documentation certifying system is acceptable for service (Manufacturer's Certificate of Acceptance).

3.04 CLEANING

A. Clean manufactured units using materials and methods approved by manufacturer. Do not use cleaners or techniques which could impair performance of the roofing system.

3.05 DEMONSTRATION

A. Instruct Owner's designated safety engineer in proper use of fall prevention devices.

END OF SECTION 07 7273

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Divisions 21, 22, 23, 26: Firestopping of mechanical, electrical, and plumbing work.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2020.

E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013 (Reapproved 2017).

F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

G. ITS (DIR) - Directory of Listed Products; current edition.

H. FM (AG) - FM Approval Guide; current edition.

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

K. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

L. UL (FRD) - Fire Resistance Directory; current edition.

M. OSSC - Oregon Structural Specialty Code: Current Edition

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Certificate from authority having jurisdiction indicating approval of materials used.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

1.05 PERFORMANCE REQUIREMENTS

A. Delegated-Design Submittal: For penetration firestopping indicated to comply with performance requirements and design criteria, including product data and, where applicable, engineering judgment drawings signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Submit submittals as "Deferred Submittals" in accordance with Section 01 30 00 - Administrative Requirements. Transmit a copy of each submittal indicating agency approval to the Architect for record.

1.06 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. For those firestop applications that exist but there is no UL tested system available through any manufacturer, a manufacturer's engineering judgement derived from similar UL system designs or other tests should be submitted by the contractor to local authorities having jurisdiction for their review and approval prior to installation.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Verification of minimum three years documented experience installing work of this type.

1.07 SEQUENCING

A. Sequence Work to permit firestopping materials to be installed after adjacent and surrounding work is complete.

1.08 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

E. Fire Ratings: See Drawings for required construction assemblies and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

1. Movement: Provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. For penetrations by combustible items including; insulated metal pipe, jacketed PVC, flexible cable or cable bundles, cable trays, and plastic pipe, an intumescent material is required to maintain fire rating of the assembly penetrated.

2.03 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
   2. Surface Burning Characteristics: Conform to OSSC.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

3.04 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. 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" or similar indication that the penetration is fire-rated.
   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.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

END OF SECTION 07 8400

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 07 2500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders:

C. Section 07 8400 - Firestopping: Firestopping sealants.

D. Section 08 8000 - Glazing: Glazing sealants and accessories.

E. Section 09 2116 - Gypsum Board Assemblies: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2017.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2018.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

E. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, color availability, and installation instructions.
   1. Include temperature ranges for storage and application of materials, and special cold-weather application requirements or limitations.
   2. SpecData sheet for substrate cleaner and substrate primer recommended by sealant manufacturer for specific substrate surface and conditions.

C. Samples: Submit two samples, 1/2 x 4 inch in size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Certificate signed by sealant manufacturer, certifying that Installer complies with requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.07 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.
   1. Provide mock-up of sealant joints in conjunction with window, wall, and air barrier system under provisions of Section 01 4000.
   2. Construct mock-up with specified sealant types and with other components noted.
   3. Locate where directed.
   4. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective workmanship within a two year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

D. 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 for Silicone Sealants: 20 years from date of Substantial Completion.
   2. Warranty Period for All other Types of Sealants: 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gunnable and Pourable Sealants:
   1. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
   2. Bostik Inc: www.bostik-us.com.
   3. Dow Corning Corporation: www.dowcorning.com.
   4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
   5. Pecora Corporation: www.pecora.com.
   6. Tremco Global Sealants: www.tremcosealants.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. *Definitions from ASTM C 920:*
   1. *Grade: Characteristics of sealant during installation. P - Pourable, NS - Non-Sag, SL, Self-Leveling,*
   2. *Class: Measurement of movement, as a percentage*
   3. *Uses: A - appropriate for Aluminum, G - appropriate for glass, I - continuously submerged, M - appropriate for Mortar, NT - for non-traffic areas, T - for traffic areas, O - for use with other substrates not listed otherwise.*
   4. *Type: Type S - Single Component, Type M - Multi-Component*

C. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25 minimum; Uses M, G, and A; single component.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Product: Similar to NP2 manufactured by Soneborn or equal.
   3. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior joints for which no other sealant is indicated.

D. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Product: Sonolac manufactured by Sonneborn or equal.
   3. Applications: Use for:
      a. Interior wall and ceiling control joints.

b. Joints between door and window frames and wall surfaces.
c. Other interior joints for which no other type of sealant is indicated.

E. Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
1. Product: Omniplus manufactured by Sonneborn or equal.
2. Applications: Use for:
a. Joints between plumbing fixtures and floor and wall surfaces.
b. Joints between kitchen and bath countertops and wall surfaces.

F. Acoustical Sealant:
1. Composition: Paintable, non-hardening acoustical sealant.
2. Applications: Use for all acoustical assemblies:
a. Sealant bead between top stud runner and structure and between bottom stud track and floor and as required to maintain specified STC rating.
3. Products:
a. Tremco Global Sealants; Acoustical Sealant: www.tremcosealants.com.
b. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com.
c. Hilti, Inc.; CP 606 (fire rated): www.us.hilti.com.
d. 3M Fire Barrier 2000 (fire-rated and paintable with primer).
e. US Gypsum; Acoustical Sealant
f. Substitutions: See Section 01 6000 - Product Requirements.

G. Interior Floor Expansion Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Product: SL-1 manufactured by Sonneborn.
3. Applications: Use for:
a. Expansion joints in floors.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave. Remove and replace sealant in joints improperly tooled.

3.04 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Provide periodic field-adhesion testing as work progresses. Submit test results after each test.
   2. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
      b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
   3. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
      a. 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.
   4. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
   5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
   6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

A. Clean adjacent soiled surfaces.

3.06 PROTECTION

A. Protect sealants until cured.

END OF SECTION 07 9005

SECTION 07 9513

EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for wall surfaces.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

C. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:
   1. Construction Specialties, Inc: www.c-sgroup.com.
   2. EMSEAL Joint Systems, Ltd: www.emseal.com/#sle.
   3. Nystrom, Inc: www.nystrom.com/sle.
   4. Watson Bowman Acme Corporation: www.watsonbowmanacme.com/#sle.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. Interior Floor Joints Subject to Seismic Movement:
   1. Manufacturers:
      a. Construction Specialties, Inc; Allway Seismic Metal Floor Covers: www.c-sgroup.com/#sle.
      b. Watson Bowman Acme Corporation; Wabo Allure: www.watsonbowmanacme.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Non-Fire-Rated Wall/Ceiling Joints Subject to Seismic Movement:
   1. Manufacturers:
      a. Construction Specialties, Inc; Flush Seismic Wall and Ceiling Covers: www.c-sgroup.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Exterior Wall Joints Subject to Seismic Movement:
   1. Manufacturers:
      a. Watson Bowman Acme, WSW-600MB, Exterior Expansion Joint Cover..
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Exterior Roof Joint Subject to Seismic Movement
   1. Products for curb to wall and curb to curb:
      a. Watson Bowman Acme, WABO Roof Cover, Exterior Roof Expansion Joint Cover.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: Wall joint, gypsum board over metal studs, ___" nominal joint width, ___ inch minimum and ___ inch maximum.
   2. Fire-Resistance Rating: None.
   3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
   1. Exposed Finish at Walls and Ceilings: Natural anodized.

B. Resilient Seals:
   1. Walls: Thermoplastic Rubber, Neoprene, or Santoprene.
   2. Color: Gray.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces, and aligned with existing adjacent joints.

C. Rigidly anchor to substrate to prevent misalignment.

END OF SECTION 07 9513

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Sound-rated hollow metal doors and frames.

E. Hollow metal borrowed lites glazing frames.

F. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 08 1416 - Flush Wood Doors.

B. Section 08 7100 - Door Hardware.

C. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

G. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

H. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

K. ASTM E413 - Classification for Rating Sound Insulation; 2016.

L. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

P. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.

Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

1.04 ADMINISTRATIVE REQUIREMENTS

A. To provide a higher level of coordination the following building materials must be provided by the same sub-contractor.
   1. 08 1113 - Hollow Metal Doors and Frames
   2. 08 1416 - Flush Wood Doors
   3. 08 7100 - Door Hardware

B. The steel door and frame supplier shall be a manufacturer or distributor regularly engaged in supplying hollow metal products in this geographic area who has competent field personnel available to consult with the Architect and Contractor regarding applications or field installation problems.

C. It is the intent of this specification to provide a general guideline for the quality, function, and design of the hollow metal doors, frames, and windows. It is the specific responsibility of the hollow steel supplier to furnish products which are fully functional, in full compliance with state and local building codes, fire codes, and disability and accessibility codes. Any supplier bidding on this section of the work shall notify the Architect prior to bidding, in accordance with Instructions to Bidders, of discrepancies or will be assumed to have included correct material to make this compliance.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C.

1.07 DEFINITIONS

A. Seamless: In addition to the requirements for full flush doors as defined in ANSI/SDI A250.8, no visible seams are permitted along the vertical edges of doors. Fabricate seams on the vertical edges by one of the following methods:
   1. Intermittently welded seams, edge filled, dressed smooth, or
   2. Continuously welded seam dressed smooth.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
   3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   4. Galvanizing : All components hot-dipped zinc-iron alloy-coated (galvannealed), minimum A40/ZF120.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

C. Hardware Preparation: In accordance with ANSI/SDI 250.6, with reinforcement welded in place, in addition to other requirements specified in door grade standard and as follows:
   1. Closers: 0.093 inch, 12 gage.
   2. Hinges: 0.167 inch, 7 gage.
   3. All other surface applied hardware: 0.067 inch, 14 gage.

D. Finish: Factory primed, for field finishing.
   1. Provide primer compatible with primers specified in Section 09 96 00 - High-Performance Coatings.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 3 - Extra Heavy-duty.
      b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
      e. Zinc Coating: G900/Z275 galvanized coating; ASTM A653/A653M.
   2. Door Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
      a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
   3. Door Thickness: 1-3/4 inches, nominal.
   4. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.
   5. Weatherstripping: Refer to Section 08 7100.

B. Interior Doors, Non-Fire Rated:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 1 - Standard-duty.
b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Door Thickness: 1-3/4 inches, nominal.
3. Door Face Sheets: Flush.
4. Door Finish: Factory primed and field finished.

C. Sound-Rated Interior Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 1 - Standard-duty.
b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
2. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 39, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.
3. Door Core Material: Manufacturer's standard construction as required to meet acoustic requirements indicated.
4. Door Thickness: As required to meet acoustic requirements indicated.
5. Sound Seals: Integral, in door and/or frame.
6. Opening Force of Sound-Rated Doors, Non-Fire-Rated: 5 pounds, maximum, in compliance with ADA Standards.

2.04 HOLLOW METAL FRAMES

A. General:
1. Comply with the requirements of grade specified for corresponding door.
a. ANSI/SDI A250.8 (SDI-100), Level 1 Door Frames: 16 gage, 0.053 inch, minimum thickness.
b. ANSI A250.8 Level 2 Doors: 16 gage frames, School District Standard for interior.
c. ANSI A250.8 Level 3 Doors: 14 gage frames, School District Standard for exterior.
d. ANSI/SDI A250.8 (SDI-100), Level 4 Door Frames: 12 gage, 0.093 inch, minimum thickness.
e. Frames for Wood Doors: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100), Level 1, 18 gage, 0.042 inch, minimum thickness.
2. Finish: Same as for door.
3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
4. Frames Wider than 48 Inches: Reinforce with steel channel fitted tightly into frame head, flush with top.
5. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.
6. Anchor: Provide anchor recommended by the frame manufacturer for the wall construction application that each frame will be located in.
7. Fully Welded Type, typical.

B. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

C. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI A250.10 and compatible with finish coats specified in Section 09 9600 - High Performance Coatings.

B. Corrosion Resistant Coating: High-build, water-resistant, resilient coating NFPA 101 Class A.

1. Product: Hi-Build Epoxoline II N69 manufactured by Tnemec or equal.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 8000, factory installed.

B. Removable Stops in steel window frames: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

D. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 FABRICATION

A. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Install top cap and mechanically attach to door to prevent water intrusion.

B. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   3. Floor Anchors: Provide adjustable base anchors at bottom of jambs. Provide fixed anchors at mullions.
   4. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry 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:
      b. Three anchors per jamb up to 90 inches high.
      c. Four anchors per jamb from 90 to 120 inches high.
      d. 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 up to 90 inches high.
         2) Five anchors per jamb from 90 to 96 inches high.
         3) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
   5. Door Silencers: Except on weather-stripped or gasketed doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Coordinate installation of hardware.

F. Coordinate installation of glazing.

G. Install glazing such that stops are on the secure side of frame, unless noted otherwise.

H. Coordinate installation of electrical connections to electrical hardware items.

I. Stud Partitions: Solidly pack mineral-fiber insulation behind frames.

J. Install door hardware as specified in Section 08 7100.

K. Comply with glazing installation requirements of Section 08 8000.

L. Coordinate installation of electrical connections to electrical hardware items.

M. Touch up damaged factory finishes.

3.03 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION 08 1113

SECTION 08 1116
ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush aluminum doors with aluminum face sheets.

B. Flush door panels.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames: Door frames.

B. Section 08 4313 - Aluminum-Framed Storefronts: Glazed aluminum doors and supports.

C. Section 08 7100 - Door Hardware: Hardware for aluminum doors.

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each type of door; include information on fabrication methods.

C. Shop Drawings: Include elevations of each opening type.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum components in manufacturer's standard protective packaging, palleted, crated, or banded together.

B. Inspect delivered components for damage and replace. Repaired components will not be accepted.

C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.

D. Protect materials and finish from damage during handling and installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty for defects in workmanship and materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flush Aluminum Doors with Aluminum Face Sheets:
   1. Arcadia, Inc: www.arcadiainc.com/#sle.
   2. Cline Aluminum Doors, Inc: www.clinedoors.com/#sle.
   3. Special-Lite, Inc: www.special-lite.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND FRAMES

A. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Flush Aluminum Doors with Aluminum Face Sheets: Aluminum internal framing and faces; no steel components.
   1. Thickness: 1-3/4 inches, nominal.
   2. Facing: Seamless aluminum sheet, 0.090 inch, smooth texture.
   3. Finish: Class I - Natural anodized.

C. Dimensions and Shapes: As indicated on drawings; dimensions indicated are nominal.
   1. Provide the following clearances:
      a. Hinge and Lock Stiles: 1/8 inch.
      b. Between Meeting Stiles: 1/4 inch.
      c. At Top Rail and Bottom Rail: 1/8 inch.

2.03 COMPONENTS

A. Flush Door Panels: Without visible seams on face sheet.
   1. Framing and Hardware Backup: Extruded aluminum tubing, 1/8 inch minimum thickness.
   2. Perimeter Edges: Extruded aluminum cap.
   3. Laminating Adhesive: Manufacturer's standard low-VOC materials.

2.04 FINISHES

A. Class I Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A41, minimum dry film thickness (DFT) of 0.7 mils, 0.0007 inch.

2.05 ACCESSORIES

A. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.

B. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.

B. Install exterior doors and frames in accordance with ASTM E2112.

C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by applying elastomeric sealant between the different metals.

D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.

E. Install door hardware, see Section 08 7100.

3.02 CLEANING

A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 & 610.

B. Do not use abrasive, caustic, or acid cleaning agents.

3.03 PROTECTION

A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.

B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

END OF SECTION 08 1116

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, and acoustical.

B. Factory finishing.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - HOLLOW METAL DOORS AND FRAMES.

B. Section 08 7100 - Door Hardware.

C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

B. ASTM E413 - Classification for Rating Sound Insulation; 2016.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. To provide a higher level of coordination the following building materials must be provided by the same sub-contractor.
   1. 08 1113 - Hollow Metal Doors and Frames
   2. 08 1416 - Flush Wood Doors
   3. 08 7100 - Door Hardware

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Test Reports: Show compliance with specified requirements for the following:
   1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

D. Warranty, executed in Owner's name.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.07 MOCKUP

A. Mockup one door with largest glass relite showing installation of door hardware, wood stops, glass and glazing tape.

B. Approved mock up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Algoma: www.algomahardwoods.com.
   2. Lynden Door, Inc.
   3. Oregon Door: www.oregondoor.com/#sle.
   4. Vancouver Architectural Doors: www.vancouverdoorco.com.
   5. VT Industries: www.vtindustries.com.
   6. Western Oregon Door; www.oregondoor.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain added urea formaldehyde or doors that comply with CA 01350, the State of California's Department of Health Services Standard Practice for testing chemical emissions from building products used in schools, offices and other sensitive environments. Third party certification for this testing is required.

B. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

C. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
   3. Sound-Rated Doors: Minimum STC of 47, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.

2.03 DOOR AND PANEL CORES

A. Doors with full light and half lite glass - Non-Rated Solid Core: Type: Staved lumber core (SLC), plies and faces as indicated.

B. All other doors - Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.

C. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

D. Sound-Rated Doors: Equivalent to type, with acoustic core construction as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White Maple - Clear Color Stain, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Any option allowed by quality standard for grade.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Fabricate any Fire Rated doors to receive panic hardware with inner blocking which will permit hardware installation without through-bolting

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Bevel edges 1/8 inch in 2 inches at lock and hinge edges.

G. Provide edge clearances in accordance with the quality standard specified.

H. Fabricate all doors with adequate reinforcement to receive door closer, whether specified to receive one or not.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Glazing: See Section 08 8000.

B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

C. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

F. At Wood Glazing Stops: Install stops flush on both faces of doors, with no door face veneer showing. Install with tight miter corners. Fill nail holes to match adjacent finish.

G. Protect veneer from damage during construction. Do not wedge open doors with any material that might cause the veneer to split or chip.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

C. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

D. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE

A. See Door and Frame Schedule in the Drawings.

END OF SECTION 08 1416

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted access units.

B. Ceiling mounted access units.

C. Floor mounted access door and frame units, interior.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.

B. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.01 WALL AND CEILING MOUNTED ACCESS UNITS

A. Manufacturers:
   1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
   2. ACUDOR Products Inc: www.acudor.com/#sle.
   3. Barco Manufacturing.
   4. Cierra Products.
   5. Dur-Red Products; www.dur-red.com.
   6. Karp Associates, Inc: www.karpinc.com/#sle.
   7. Milcor, Inc: www.milcorinc.com/#sle.
   8. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Material: Steel.
   2. Style: Exposed frame with door surface flush with frame surface.
      a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
      b. Plaster Mounting Criteria: Use plaster bead type frame.
   3. Door Style: Single thickness with rolled or turned in edges.
   4. Frames: 16 gauge, 0.0598 inch, minimum thickness.
   5. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
   6. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
      a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
   7. Steel Finish: Primed.
   8. Primed and Factory Finish: Polyester powder coat; color as scheduled.
   9. Door/Panel Size: As indicated on the drawings.
   10. Hardware:
      a. Hardware for Fire-Rated Units: As required for listing.

b. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
c. Latch/Lock: Screw driver slot for quarter turn cam latch.

2.02 FLOOR ACCESS UNITS

A. Floor Access Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Size: As indicated on drawings.
   2. Hardware: Steel, hot-dipped galvanized.
      a. Hinges: Removable pin.

B. Interior Floor Mounted Access Units: Aluminum, minimum 1/4 inch thick.
   1. Design Load: Design to support live load of 150 psf with deflection not to exceed 1/180 of span.
   2. Operation: Manual opening, and manual closing.
   3. Cover Pattern: Diamond tread plate.
   4. Finish: Mill finish.
   5. Manufacturers:
      a. ACUDOR Products Inc: www.acudor.com/#sle.
      b. BILCO Company; Type K - Angle Frame, aluminum: www.bilco.com/#sle.
      c. Cendrex, Inc; PPA, aluminum, flush diamond plate: www.cendrex.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION 08 3100

SECTION 08 3313
COILING COUNTER DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated coiling counter doors and operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Metal supports.

B. Section 09 2116 - Gypsum Board Assemblies: Rough openings.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. Include data on electrical operation.

C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.

D. Samples: Submit two slats, 4 inch long, illustrating shape, color and finish texture.

E. Manufacturer's Instructions: Indicate installation sequence and installation, adjustment, and alignment procedures.

F. Operation and Maintenance Data: Indicate modes of operation, lubrication requirements and frequency, and periodic adjustments required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coiling Counter Doors:

1. Basis of Design: Series 651 by Ovehead Door Corporation: ww.overheaddoor.com.
2. Other approved manufacturers:
   a. Cornell Iron Works, Inc: www.cornelliron.com.
   b. The Cookson Company: www.cooksondoor.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING COUNTER DOORS

A. Coiling Counter Doors, Non-Fire-Rated: Stainless steel slat curtain.

1. Mounting: Interior face mounted.
2. Nominal Slat Size: 1-1/4 inches wide.
3. Slat Profile: Flat.
4. Finish Factory powder coat finish, as selected by architect from manufacturers full range of standard colors.
5. Guides: Formed track; same material and finish unless otherwise indicated.
6. Manual push up operation.
7. Locking Devices: Slide bolt on inside.

2.03 MATERIALS

A. Curtain Construction: Interlocking, single thickness slats.

1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
3. Stainless Steel Slats: ASTM A666, Type 304; minimum thickness 22 gauge, 0.03 inch.

B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
1. Stainless Steel Guides: ASTM A666, Type 304, rollable temper.

C. Hood Enclosure: Internally reinforced to maintain rigidity and shape.

D. Lock Hardware:
1. Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.

E. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION 08 3313

SECTION 08 3323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior non-fire-rated coiling doors, electrically operated.

B. Electric operators and control stations.

C. Wiring from electric circuit disconnect to operators and control stations.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Support framing.

B. Section 08 31 00 - Access Doors and Panels: Access doors.

C. Section 08 33 13 - Coiling Counter Doors

D. Section 26 0583 - Wiring Connections: Power to disconnect.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ITS (DIR) - Directory of Listed Products; current edition.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).

F. NEMA MG 1 - Motors and Generators; 2018.

G. UL (DIR) - Online Certifications Directory; Current Edition.

H. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, electrical equipment, and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Series 651 by Overhead Door Corporation: www.overheaddoor.com

B. Overhead Coiling Doors:
   1. Cornell Iron Works, Inc: www.cornelliron.com/#sle.
   2. The Cookson Company: www.cooksondoor.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING DOORS

A. Interior Non-Fire-Rated Coiling Doors: Stainless steel slat curtain.
   1. Nominal Slat Size: 2 inches wide by required length.
   2. Finish: Factory powder coat finish, as selected by architect from manufacturers full range of standard colors.
   3. Guides, Angles: Stainless steel.
   4. Hood Enclosure: Manufacturer's standard; galvanized steel.
   5. Electric operation.
   6. Mounting: Surface mounted.
   7. Locking Devices: Slide bolt on inside.

2.03 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Hinged slats.
   1. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Stainless Steel Slats: Minimum thickness, 22 gauge, 0.03 inch, complying with ASTM A 666, Type 304, rollable temper.

B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
   1. Stainless Steel: ASTM A 666, Type 304, rollable temper.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

E. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

F. Security System Coordination: Provide compatible magnet at jamb in closed position.

2.04 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.

B. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Enclosure:
      a. Interior Coiling Doors: NEMA MG 1, Type 1; open drip proof.
   3. Motor Rating: 1/3 HP; continuous duty.
   4. Motor Voltage: 120 volts, single phase, 60 Hz.
   5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   6. Controller Enclosure: NEMA 250, Type 4.
   7. Opening Speed: 12 inches per second.
   8. Brake: Manufacturer's standard type, activated by motor controller.
   9. Manual override in case of power failure.

C. Keyed Control Station: Provide standard three button, "Open-Close-Stop" momentary-contact control device for each operator complying with UL 325.
   1. 24 volt circuit.
   2. Recess mounted, at interior door jamb.
   3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
      a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 26 0583.

F. Complete wiring from disconnect to unit components.

G. Install enclosure and perimeter trim.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION 08 3323

SECTION 08 4229

AUTOMATIC ENTRANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automatic Sliding Doors

B. Operators.

C. Controllers, actuators and safety devices.

1.02 RELATED REQUIREMENTS

A. Section 08 4313 - Aluminum Framed Storefronts

B. Section 08 8000 - Glazing

C. Division 26 - Electrical: Electrical power to operator.

D. Division 28 - Electronic Safety and Security: Security system signal to operator.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI A117.1 - American National Standard for Accessible and Useable Buildings and Facilities.

C. ANSI A156.10 - Power Operated Pedestrian Doors.

D. ANSI/UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems - (UL) listed.

E. ANSI-Z97.1.2 - Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings.

F. Aluminum Association Standard AA DAF-45 - Designation System for Aluminum Finishes.

G. Miami-Dade County Building Code Compliance Office (BCCO) Notice of Acceptance (NOA)

H. NFPA 101 - Life Safety Code.

I. AAADM - American Association of Automatic Door Manufacturers/

J. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2017.

K. BHMA A156.10 - American National Standard for Power Operated Pedestrian Doors; 2017.

L. BHMA A156.19 - American National Standard for Power Assist and Low Energy Power Operated Doors; 2013.

M. ITS (DIR) - Directory of Listed Products; current edition.

N. NEMA MG 1 - Motors and Generators; 2018.

O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL (DIR) - Online Certifications Directory; Current Edition.

R. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.

C. Product Data: Include system components, sizes, features, and finishes.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

E. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Wrenches and other tools required for maintenance of equipment.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience, and a member of AAADM.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide two year manufacturer warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sliding Automatic Entrance Door Assemblies:
   1. Tormax Technologies, Inc., 12859 Wetmore Rd. ; San Antonio, TX 78247; Toll Free Tel: 888-685-3707; Tel: 210-494-3551; Email: (info@tormaxusa.com); Web:www.tormaxusa.com
   2. Substitutions: Not permitted.

2.02 POWER OPERATED DOORS

A. Telescoping Automatic Sliding Door: Model TX9200AC by Tormax.

B. Bi-part inside slide application (SO-SX-SX-SO).

C. Power Operated Doors: Provide products that comply with NFPA 101 and requirements of authorities having jurisdiction; provide equipment selected for actual door weight and for light pedestrian traffic, unless otherwise indicated.
   1. Sliding and Folding Door Operators: In the event of power failure, provide for manual open, close, and break-away operation of door leaves.
   2. Packaged Door Assemblies: Provide components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties.
   3. Exterior and Vestibule Doors: Provide equipment suitable for operating temperature range of minus 20 to plus 140 degrees F ambient.

D. Sliding and Folding Doors with Full Power Operators: Comply with BHMA A156.10; safeties required; provide break-away operation unless otherwise indicated; in the event of break-away operation, interrupt power operation.
   1. Comply with UL 325; acceptable evidence of compliance includes UL (DIR) or ITS (DIR) listing or test report by testing agency acceptable to authorities having jurisdiction.
   2. Force Required to Swing Break-Away Panel: 50 pound-force, maximum, measured at 1 inch from the latch edge of the door at any point in the closing cycle.

E. Operators:
   1. Electric Operators: 1/8 hp minimum, self-contained, belt driven, with release clutch.

2.03 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

A. Comply with ADA Standards for egress requirements.

B. Framing Members: Provide manufacturer's standard extruded aluminum framing, reinforced as required to support imposed loads.

1. Nominal Sizes:
    a. Single Slide and Bi-Parting Sliding Doors: 1-3/4 inch wide by 4-1/2 inch deep.
2. Concealed Fastening: Provide concealed fastening pocket in framing, with continuous flush insert cover extending full length of each framing member.

C. Door and Sidelight Construction: Heavy duty interlocked extruded aluminum tubular stile and rail sections, through-rod bolted construction with steel corner support at hinge stile of carrier-suspended swinging panels or mechanically fastened corners with welded reinforcing brackets to reduce sag in sliding or breakout mode.
1. Door Thickness: 1-3/4 inch, nominal.
2. Stile Design:
    a. Narrow stile, 2 inch, nominal width.
3. Top Rail Height: 4 inch, nominal.
4. Bottom Rail Height: 4 inch, nominal.
5. Glazing Stops: Manufacturer's standard snap-on extruded aluminum square stops with preformed resilient glazing gaskets.
6. Glazing Stop Width: Manufacturers standard.
7. Glazing Thickness: 1/4 inch.

D. Sliding Aluminum Doors: Provide door panel(s) with corner block construction to sizes indicated. Outer fast and inner slow sliding door panels allow "breakout" to the full open position and provides instant egress at any point in the door's movement. Provide with spring return closers to return the panel when broken out for emergency egress. Each door panel includes full-length interlocking extrusion that securely latches the swing out panel(s) to the sliding panel(s) in the fully closed position. Size doors and swing-out sidelights to prevent pinch points at meeting stiles.
1. Door Type:
    a. Medium stile with intermediate rail.
    b. Bi-part slide
    c. For two-way traffic
2. Glazing Thickness: Doors are field glazed as specified in Section 08 8000 - Glazing. Provide with security glass stops for the following glass
    a. At exterior doors: 1 inch (25 mm).
    b. At interior doors: ¼ inch (6 mm)
3. Automatic Locking Hardware: Limited Access security consists of electric solenoid lock and flush mount concealed vertical rod exit panic hardware. Electric solenoid locking is a 115 VAC fail-secure solenoid with self-contained solid-state electronic control factory installed inside TX9000 header. Solenoid lock is operational in the "Off" and "Exit" mode of operation. Lock is engaged in the "Off" mode of operation and with the unit in the "Exit" mode, solenoid lock retracts upon receipt of an operate signal from an actuating control allowing doors to open. Upon loss of signal the doors will slide closed. Solenoid lock shall self-latch in the closed position, returning system to locked status. During a power interruption, solenoid lock shall remain locked in the "Off" and "Exit" mode of operation, securing the doors in the closed position. Egress is provided with flush mounted panic bar allowing doors to breakout. Lock may be reprogrammed at the job-site for fail-safe type operation.

E. Aluminum Frame and Extrusions: Provide with minimum .125 inch (3 mm) wall thickness in integral structural sections. Frame shall be 8 inches (204 mm) deep by 2 inches wide (51 mm) section.

F. Aluminum Sidelights: Provide sidelight panel(s) with corner block construction to sizes indicated. Each panel shall include a full-length interlocking extrusion that securely latches the swing out panel(s) to the sliding panel(s) in the fully closed position. Sidelight(s) shall swing out and allow the sliding door(s) to "breakout" to the full open position for instant egress at any point in the door's movement per NFPA 101. Sidelight panel(s) shall contain a hydraulic dampener to control the swing of the panel in the event of a breakaway condition.
1. Type:

a. Medium stile with intermediate rail.

2. Glazing Thickness: Sidelights are field glazed as specified in Section 08 80 00 - Glazing. Provide with security glass stops for the following glass thickness:
   a. At interior doors: 1/4 inch (6 mm)
   b. At exterior doors: 1 inch (25 mm).

G. Header Case: Aluminum extruded header contains the TORMAX iMotion direct drive system and door mounting components over a span of 14 feet (4267 mm) with minimal deflection.
   1. iMotion 2401 Direct Drive: For use with sliding one single door leaf weighing up to 265 pounds (120 kg) or two bi-parting door leafs weighing up to 220 pounds (100 kg) each.
      a. Concealed Mount Header: Extruded aluminum, 13 inches wide by 8 inches high (330 mm by 203 mm). Provide with extruded aluminum hinged cover allowing it to open approximately flush with the top of the header.

H. Door Hanger Wheels:
   1. Each door is suspended from an overhead track by nylon wheels with steel lifetime lubricated ball bearings. iMotion 2301 requires four 2-1/2 inch (64 mm) diameter wheels and held on track by two 7/8 inch (22 mm) diameter nylon anti-riser wheels. iMotion 2401 uses eight 2-1/2 inch (64 mm) diameter nylon wheels and held on track by four 7/8 inch (22 mm) diameter nylon anti-riser wheels. Roller track is field replaceable and isolated in rubber for smooth and quite operation. Each door supported by a factory adjusted cantilever support pivot assembly that allows doors to swing outward for emergency egress and spring return closed without the need for a lower door pivot support. Door height has an adjustment of 1/2 inch (13 mm).

I. Guide Threshold Track: Provide aluminum threshold track to guide the sliding panels from close to open and open to close. Provide with continuous threshold with following profile:
   1. Surface combination surface bevel/square continuous full width inside jamb to inside jamb.

J. Synchronized 2:1 Gear Reduction Unit: Sequencing of the outer "fast" panel and "inner" slow panel(s) shall be controlled by the 2:1 gear reduction unit. Unit shall permit both panels to arrive at the full open position together providing. Pulley or cable systems are not permitted.

K. Accessories: Provide with following accessories:
   1. Weather-stripping: Provide nylon sweep on the bottom of each sliding door panel; two rows of wool pile weather-stripping at the leading edge of the active sliding door and the back edge of the sidelight panel; wool pile weather-stripping between the header and sidelight top rail; wool pile weather-stripping between the lead stile of the sidelight an the pivot stile of the of sliding doors.
   2. rubber vinyl weather-stripping between the header and the sidelight top rails.
   3. Provide with electric lock
   4. Provide with door position monitoring
   5. Provide with I/O module
   6. Provide with key switch

L. AUTOMATIC SLIDING DOOR DRIVE AND CONTROL SYSTEM
   1. Direct Drive System: TORMAX iMotion Direct Drive System consists of a gearless direct drive AC Synchronous motor with a frequency converter to control door speeds and a self-learning fully programmable iMotion microprocessor control unit. System includes an integrated distance measuring system that shall be protected against external interference to guarantee maximum operational performance. System maintains optimal performance at all times by use of an on-board self-adjusting closed loop fully programmable iMotion microprocessor control system that periodically checks the doors operating limits and makes automatic adjustments to compensate for temperature, wind, dust, stack pressure and other outside factors which may alter systems performance.
      a. iMotion Direct Drive Type:
         1) iMotion 2401 Direct Drive .40 HP motor.
      b. Control Unit: iMotion Microprocessor Control is fully programmable system that monitors doorway holding beams, door position, electric lock position, activators,

motor temperature, condition of battery, and emergency off button. Control system continual performs self-diagnostic system checks and displays faults by flashing LED's on an external illuminated seven-segmented function control panel. Torque is factory set as per ANSI A156.10. Control unit and integrated distance measuring system automatically calibrates the opening and closing check positions, and the full open and full closed position of door system. Controller provides four programmable inputs for activators, key switch and mode of operation, four programmable inputs for safety and two auxiliary output signals for door position status, alarm, etc.

1) Provide with optional I/O module with four additional inputs and four additional outputs.
2) Doorway Holding Beams: Doorway holding beams will be factory installed when required by design at 24 inches (610 mm) and 48 inches (1219 mm) from finished floor. When interrupted beams inhibit open door from closing. Beams are disabled in door-closed position. TORMAX iMotion microprocessor control monitors the performance for proper function of each DHB every 20 seconds and before each closing cycle. If DHB fault is detected door(s) will close in a creep speed.
3) Reverse on Obstruction Open and Close with Safety Search Circuitry: Doors stop and recycle open if an obstruction is encountered during the closing cycle. Safety search feature allows doors to cycle close at creep speed. If an obstruction is encountered while opening, doors will stop, reverse direction and close. Safety search feature allows doors to cycle open at creep speed. After obstruction is removed a new calibration is run and doors returned to normal operation. Reverse on obstruction sensitivity is adjustable and programmed from the function control panel.
4) Door Motion Adjustments: An illuminated seven-segmented function control pane provides for six operating modes, system configuration and auto-diagnostics and the following adjustments; opening and closing speeds, hold open time for full door opening width, hold open time for reduced door opening width, reduced door opening width size and manual operation (free wheeling). iMotion microprocessor controller shall optimize all other motion setting such as, acceleration and braking distances. Control panel provides for auto-diagnostics and is protected against unauthorized manipulation by an integrated access code and/or optional key switch.
5) Mode of Operation: Illuminated seven-segmented function control panel provides six modes of operation.
   (a) OFF - Door opening activators inhibited. If doors are open when activators are inhibited DHB remains functional until doors are fully closed.
   (b) AUTOMATIC - Standard two way automatic operation (open/time out/close)
   (c) AUTORED - Doors automatically open at a reduced width.
   (d) EXIT - (One-Way Traffic) Egress side activation sensor is inhibited when doors are in fully closed position without use of switches and magnets.
   (e) OPEN - Doors power open and stay open. Door opening width is dependent on previously selected operating mode (AUTO or AUTORED)
   (f) MANUAL OPERATION - Doors used manually "friction free manual operation" Door activating sensors are inhibited.

c. Delta III Sensor: Unit is selectable for bi-directional or unidirectional detection and consists of five rows of focused active infrared with motion and presence detection. Threshold safety provides by two rows of presence detection closest to face of door. Motion and presence detection performance meets or exceeds ANSI/BHMA A156.10, Sections 8.1.1, 8.1.2, 8.1.3 and 8.3.2.3. Unit has dipswitch selectable rain and snow modes for extreme environments and four dipswitch selectable frequencies to eliminate interference from other infrared devices. Unit provides an extra-wide pattern to cover the door opening and sidelights, with detection for fast approaching traffic from any angle. Response time is less than .3 seconds in both directions with a relay hold time of .5 to 2 seconds. Approach width is adjusted by dipswitch. Shutters adjust

the width of the motion presence area. Vertical angle adjustment are plus or minus 15 degrees for approach area and plus 5/ minus 8 degrees for motion/presence area. Supply voltage is 12-24 VAC or 12-30 VDC. Maximum power consumption is 250mA. Cover is black ABS plastic. Size is 11-31/32 inches W (304 mm) by 2-3/4 inches H (70 mm) by 2-19/32 inches D (66 mm).

d. PUSH TO EXIT: Provide manual door actuating devices on interior (secure side) of both active leafs.

M. FACTORY FINISH
1. Provide aluminum finishes in accordance with Aluminum Association Standard AA DAF-45.
a. AA-M12-C22-A31 Clear anodized.
2. Exposed Operator and Components: Finish
a. As selected from manufacturer's standard range.

2.04 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:
1. 5 rated load amperes.
2. 120 volts, single phase, 60 Hz.

B. Motors: NEMA MG 1.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

2.05 GLAZING

A. As specified in Section 08800 Glazing for interior and exterior glazing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available and is of the correct characteristics.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.

C. Provide for dimensional distortion of components during operation.

D. Install pneumatic lines and door power units in a manner to prevent condensation or freezing.

E. Coordinate installation of components with related and adjacent work; level and plumb.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.04 FIELD QUALITY CONTROL

A. Manufacturers representative to verify that installation of doors and controls are in conformance to the manufacturer's recommendations.

3.05 CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.06 CLOSEOUT ACTIVITIES

A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

END OF SECTION 08 4229

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior Aluminum-framed storefront, with vision glass.

B. Interior Aluminum-framed storefront, with vision glass

C. Aluminum doors and frames.

D. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

C. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

H. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

F. Samples: Submit two samples 6 x 6 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

G. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12” (300 mm) 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.

H. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

I. Fenestration Certificate: To facilitate Energy Code compliance, provide a certificate specifying glazing type, special coatings, spacers, gas fills, center-of-glass and overall U-factor, and center-of-glass SHGC for every type of site built glass used. Maintain on the jobsite available for the building inspector.

J. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 MOCK-UP

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide two year warranty against defects in material and workmanship of curtainwall components.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exterior Storefront Basis of Design: Kawneer; Product Trifab VG 451UT.
   1. Other Acceptable - Aluminum-Framed Storefronts Manufacturers:
      a. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Storefront Basis of Design: Kawneer, Product Kawneer; Product Trifab VG 450
   1. Other Acceptable - Aluminum-Framed Storefronts Manufacturers
      a. Oldcastle Building Envelope: www.oldcstlebe.com
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulating glazing.
   2. Glazing Position: Centered (front to back).
   3. Mullion Dimensions: 2 inches wide by 4-1/2 inches deep, typical.
   4. Horizontal sill framing at grade: 4 inches minimum, similar to Kawneer "Sidelite Base".
   5. Finish: Superior performing organic coatings.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   6. Finish Color: As selected by Architect from manufacturer's standard line.
   7. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   8. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   9. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   10. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   11. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   12. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   13. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

B. Performance Requirements
   1. Wind Loads: Design and size components and system attachment methods to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Design Wind Loads: Comply with requirements of ASCE 7, basic wind speed of 95 mph.
      b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8.00 lbf/sq ft as defined in AAMA 501.
   3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
   4. Condensation Resistance Factor of Framing: 60, minimum, measured in accordance with AAMA 1503 with 1 inch insulating glass installed.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.

3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Swing Doors: Glazed aluminum.
   1. Similar to Kawneer 500T InsulPour Thermal Entrance.
   2. Thickness: 2-1/4 inches.
   3. Top Rail: 5 inches wide.
   4. Vertical Stiles: 5 inches wide.
   5. Bottom Rail: 10 inches wide.
   6. Glazing Stops: Square.
   7. Finish: Same as storefront.

C. Operable Sash: Aluminum project-in hopper; finished to match storefront; heavy-duty 4-bar hinges, and cam turn handle latch with manufacturer's standard insect screen.
   1. Basis-of-Design product:
      a. Kawneer; 8225TL Isolock Hopper Window
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Sills: Aluminum, thermally-broken, manufacturer's standard for locations detailed.

E. Deflection head channels/receptors: Aluminum, thermally-broken, manufacturer's standard for locations detailed.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M) 6063-T6 alloy and temper.

B. Structural Steel Sections: ASTM A36/A36M; shop primed.

C. Fasteners: Stainless steel.

D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.

E. Concealed Flashings: 0.018 inch thick galvanized steel.

F. Glass: As specified in Section 08 8000.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: As specified in Section 08 8000.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.06 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Door Hardware: As specified in Section 08 7100, except as included below.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

F. Kick Plates: Synthetic sheet matching door finish. Kawneer Kydex Wear Shield or approved.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce components internally for door hardware .

G. Reinforce framing members for imposed loads.

H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
   1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

K. Install operating sash.

L. Set thresholds in bed of sealant and secure.

M. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.

N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. Test installed storefront for air infiltration in accordance with ASTM E783, with infiltration not to exceed 0.09 cfm/square foot.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 4313

SECTION 08 7100

DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Thresholds.

E. Weatherstripping and gasketing.

F. Gate locks.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealants for setting exterior door thresholds.

B. Section 08 1113 - HOLLOW METAL DOORS AND FRAMES.

C. Section 08 1416 - Flush Wood Doors.

D. Section 08 7110 - Door Hardware Schedule: Schedule of door hardware sets.

E. Section 28 1000 - Access Control: Electronic access control devices.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.1 - American National Standard for Butts and Hinges; 2016.

C. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

D. BHMA A156.6 - American National Standard for Architectural Door Trim; 2015.

E. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2015.

F. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical; 2015.

G. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2018.

H. BHMA A156.21 - American National Standard for Thresholds; 2014.

I. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems Sponsor; 2017.

J. BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems; 2018.

K. DHI (H&S) - Sequence and Format for the Hardware Schedule; 1996.

L. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

M. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

R. OSSC - Oregon Structural Specialty Code; latest edition

S. UL (DIR) - Online Certifications Directory; Current Edition.

T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. This specification is intended as a guideline for quality and operation and is not to be construed as a complete list. It is the specific responsibility of the hardware supplier to furnish complete hardware for all openings that is functional, meets the Owner's intended use, and in full compliance with all State and Local Building Codes, Fire Codes, disability and accessibility codes. Any supplier bidding on this section of the work shall notify the Architect prior to bidding, in accordance with Division 0 requirements of discrepancies or will be assumed to have included correct material to make this compliance

B. To provide a higher level of coordination the following building materials must be provided by the same sub-contractor.
   1. 08 1113 - Hollow Metal Doors and Frames
   2. 08 1416 - Flush Wood Doors
   3. 08 7100 - Door Hardware

C. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

E. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

F. Keying Requirements Meeting:
   1. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Architect.
      d. Installer's Architectural Hardware Consultant (AHC).
      e. Owner's Security Consultant.
   2. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Access control requirements.
   4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
   5. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
      a. Submit in vertical format; see Section 08 0671.

3. List groups and suffixes in proper sequence.
4. Door numbers must be in numerical sequence.
5. Provide complete description for each door listed.
6. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
    a. Include clean and clear digital catalog cut sheets with products to be used on the project properly highlighted.
7. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

G. Keying Schedule:
1. Submit one digital copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

J. Operations & Maintenance Data: Hardware supplier will reissue a complete schedule when changes occur during the project, and will supply the contractor with a digital copy of the final hardware schedule for the O & M Manual.

K. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Lock Cylinders: Ten for each master keyed group.
3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 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 for commercial door hardware with at least three years of documented experience.

C. Hardware Supplier Qualifications: Company specializing in supplying the type of products specified in this section with at least three years documented experience, and with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

D. Prior to final project acceptance, supplier's representative shall make one field inspection and certify, in writing to the Architect, that hardware installation complies with the project documents, approved hardware schedule, and Manufacturer's instructions, and that installation is complete

and all hardware items have been properly installed and correctly adjusted, or provide a list of items that require correction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide Manufacturer's Standard Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
   1. Closers: Five years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 RESPONSIBILITY

A. This specification is intended as a guideline for quality and operation and is not to be construed as a complete list. It is the specific responsibility of the hardware supplier to furnish complete hardware for all openings that is functional, meets the Owner's intended use, and in full compliance with all State and Local Building Codes, Fire Codes, disability and accessibility codes. Any supplier bidding on this section of the work shall notify the Architect prior to bidding, of any observed discrepancies or will be assumed to have included correct material to make this compliance.

2.02 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   4. All Hardware on Fire-Rated Doors Except Hinges: Listed and classified by UL as suitable for the purpose specified and indicated.
   5. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply air leakage requirements of the applicable code.
   6. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
   1. Coordinate the installation, wiring and operation of any automatic door operators and electric strikes with any access control system.

E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Door Hardware Schedule.

F. Surface Mounted Closers: Check degree of opening for all closers. Mount closer away from exterior, halls, corridors and public spaces. Notify Architect during the Submittal Review

process if specified closers do not comply with this requirement. Unless specifically specified, do not restrict door swing.

G. Finishes: As identified in Door Hardware Schedule.

H. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications, and as follows:
      a. Mineral Core Wood Doors: Sex bolts.
      b. Closers at Wood Doors: Sex bolts.
      c. Concrete and Masonry Substrates: Stainless steel machine screws and lead expansion shields.

2.03 HINGES

A. Hinges: Provide hinges on every swinging door unless otherwise indicated.
   1. Provide five-knuckle full mortise ball-bearing butt hinges unless otherwise indicated.
   2. Provide hinges in the quantities indicated.
   3. Provide non-removable pins on all outswinging exterior and interior doors.
   4. Where electrified hardware is mounted in door leaf, provide power transfer hinges unless otherwise indicated.

B. Manufacturers:
   1. McKinney; an Assa Abloy Group company: www.assaabloydss.com.
   2. Bommer Industries, Inc: www.bommer.com/#sle.
   3. Hager Companies: www.hagerco.com/#sle.
   4. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

C. Grade: Comply with BHMA A156.1, Grade 1.

2.04 FLUSH BOLTS

A. Manufacturers:
   1. Ives, an Allegion brand: www.allegion.com/us/#sle.
   2. Substitutions: Not permitted.

2.05 EXIT DEVICES

A. Manufacturers:
   1. Von Duprin, an Allegion brand: www.allegion.com/us.
   2. Substitutions: Not permitted.

2.06 ELECTRIC STRIKES

A. Manufacturers:
   1. Basis of Design: Von Duprin: www.vonduprin.com.
   2. Substitutions: Not permitted.

2.07 LOCK CYLINDERS

A. Manufacturers:
   1. Basis of Design: Schlage, an Allegion brand: www.allegion.com/us.
   2. Substitutions: Not permitted.

B. Exterior Cylinders: Schlage Primus to match Owner standards.

2.08 CYLINDRICAL LOCKS

A. Manufacturers:
   1. Schlage, an Allegion brand: www.allegion.com/us.
   2. Substitutions: Not permitted.

2.09 MORTISE LOCKS

A. Manufacturers:
   1. Schlage, an Allegion brand: www.allegion.com/us.

2. Substitutions: Not permitted.

2.10 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
   1. Ives: www.allegion.com.
   2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
   3. Hager Companies: www.hagerco.com/#sle.
   4. Trimco: www.trimcohardware.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Door Pulls and Push Plates: Comply with BHMA A156.6.
   1. Pull Type: Straight, unless otherwise indicated.
   2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
      a. Edges: Beveled, unless otherwise indicated.
   3. Material: Aluminum, unless otherwise indicated.

2.11 DOOR PULLS AND PUSH BARS

A. Manufacturers:
   1. Ives: www.allegion.com.
   2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
   3. Hager Companies: www.hagerco.com/#sle.
   4. Trimco: www.trimcohardware.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Door Pulls and Push Bars: Comply with BHMA A156.6.
   1. Bar Type: Bar set, unless otherwise indicated.
   2. Material: Stainless steel, unless otherwise indicated.

2.12 COORDINATORS

A. Manufacturers:
   1. Basis of Design: Ives, an Allegion Brand , www.allegion.com/us.
   2. Substitutions: Not permitted.

2.13 CLOSERS

A. Manufacturers; Surface Mounted:
   1. Basis of Design: LCN, an Allegion brand: www.allegion.com/us..
   2. Substitutions: Not permitted.

B. Closers: Comply with BHMA A156.4, Grade 1.
   1. At outswinging exterior doors, mount closer on interior side of door.

2.14 AUTOMATIC DOOR OPERATORS

A. Manufacturers; Surface Mounted:
   1. Norton; an Assa Abloy Group company: www.assaabloydss.com.
   2. LCN, an Allegion brand: www.allegion.com/us.
   3. Stanley, dormakaba Group: www.stanleyhardwarefordoors.com/#sle.
   4. Tormax: www.tormax.com/en
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.15 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
   1. DORMA USA, Inc; 900 Series: www.dorma.com/#sle.
   2. Glynn-Johnson, an Allegion brand: www.allegion.com/us.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.

2.16 PROTECTION / KICK PLATES

A. Manufacturers:

1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
2. Hager Companies: www.hagerco.com/#sle.
3. Ives, an Allegion brand: www.allegion.com/us.
4. Trimco: www.trimcohardware.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Protection Plates: Comply with BHMA A156.6.

C. Metal Properties: Stainless steel.
1. Metal, Heavy Duty: Thickness 0.062 inch, minimum.

D. Edges: Beveled, on four sides unless otherwise indicated.

E. Fasteners: Countersunk screw fasteners.

2.17 ELECTROMAGNETIC DOOR HOLDERS

A. Manufacturers:
1. Rixson; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. DORMA USA, Inc: www.dorma.com/#sle.
3. Hager Companies: www.hagerco.com/#sle.

B. Electromagnetic Door Holders: Comply with BHMA A156.15.
1. Type: Wall mounted, single unit, heavy duty, with strike plate through-bolted to door.
2. Holding Force, Heavy Duty: 35 lbs-force, minimum.
3. Voltage: 12 VDC, and provide power supplies by same manufacturer as holders.
4. Provide interface with fire detectors and fire-alarm system for fire-rated door assemblies.

2.18 WALL STOPS

A. Manufacturers:
1. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
2. Hager Companies: www.hagerco.com/#sle.
3. Hiawatha, Inc, division of Activar Construction Products Group, Inc: www.activarcpg.com/hiawatha/#sle.
4. Ives, an Allegion brand: www.allegion.com/us.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Provide wall stops to prevent damage to wall surface upon opening door.
2. Type: Bumper, concave, wall stop.
3. Material: Stainless steel housing with rubber insert.

2.19 THRESHOLDS

A. Manufacturers:
1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.
2. National Guard Products, Inc: www.ngpinc.com.
3. Zero International, Inc: www.zerointernational.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at each exterior door, unless otherwise indicated.
2. Type: Interlocking.
3. Material: Aluminum.
4. Threshold Surface: Fluted horizontal grooves across full width.
5. Field cut threshold to profile of frame and width of door sill for tight fit.
6. Provide non-corroding fasteners at exterior locations.

2.20 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
1. Pemko; an Assa Abloy Group company: www.assaabloydss.com.

2. Hager Companies: www.hagerco.com/#sle.
3. Ives, an Allegion brand: www.allegion.com/us.
4. National Guard Products, Inc: www.ngpinc.com.
5. Zero International, Inc: www.zerointernational.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
1. Head and Jamb Type: Adjustable.
2. Door Sweep Type: Encased in retainer.
3. Material: Aluminum, with brush weatherstripping.
4. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
5. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.21 SILENCERS

A. Manufacturers:
1. Ives, an Allegion brand: www.allegion.com/us.
2. Rockwood; an Assa Abloy Group company: www.assaabloydss.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Silencers: Provide at equal locations on door frames without seals or gaskets to mute sound of door's impact upon closing.
1. Single Door: Provide three on strike jamb of frame.
2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
3. Material: Rubber, gray color.

2.22 KEY CABINET

A. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
1. Mounting: Wall-mounted.
2. Capacity: Actual quantity of keys, plus 10 percent additional capacity.
3. Horizontal metal hook strips with replaceable labels covered with clear plastic.
4. Finish: Baked enamel, manufacturer's standard color.

2.23 FIRE DEPARTMENT LOCK BOX

A. As specified in section 10 4400 Fire Protection Specialties.

2.24 KEYING

A. Door Locks: Grand master keyed.
1. Include construction keying.

B. Supply keys in the following quantities:
1. 2 change keys for each lock .
2. Construction keys as required by Contractor.

2.25 FINISHES

A. Finishes: Identified in Section 08 0671 - Door Hardware Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Use templates provided by hardware item manufacturer.

D. Do not install surface mounted items until application of finishes to substrate are fully completed.

E. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
   2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.

F. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.
   1. See Section 07 9200 for additional requirements.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 4000 - Quality Requirements.

B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

D. Test and adjust all Locks and Latches, including Lock Keyways for smooth and easy operation.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION 08 7100

SECTION 08 7110
DOOR HARDWARE SCHEDULE

HW SET # C-01 - Not Used

HW SET # C-02

Openings

A201A	B104A	B104B	B201A	C104A	C201A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HWBSC 5	652	IVE
1	EA	PANIC HARDWARE	LD-9827-EO-LBR	626	VON
1	EA	PANIC HARDWARE	LD-9827-NL-LBR	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA WMS	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	MAG HOLDER	999M	689	RIX
2	EA	SILENCER	SR64	GRY	IVE

WALL MAGNETS REQUIRE SOLID SURFACE TO MOUNT.
CONTROLLED BY SECURITY SYSTEM, FIRE ALARM SIGNAL, OR LOCKED BY LOCKDOWN SWITCH.
REENTRY BY KEY ONLY, SUBJECT TO AHJ APPROVAL

HW SET # C-03

Openings

A102A	A106A	A107A	A108A	A109A	A111A
A112A	A123A	A124A	A202A	A203A	A204A
A206A	A207A	A208A	A209A	A221A	A222A
B107A	B108A	B109A	B118A	B124A	B127A
C111A	C204A	C206A	C208A	C213A	C219A
C221A					

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL VESTIBULE LOCK	ND93P6D RHO XN12-035	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-04

Openings

A104A A104B B116A B203A C127A C207A
C214A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET # C-05

Openings

A113A A122A C106C

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-98-NL	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4041 DEL SCUSH WMS	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		
			POWER SUPPLY - WORK OF DIVISION 28		
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

VERIFY THRESHOLD DETAIL

HW SET # C-06

Openings

A114A A212A B122A B211A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	FAC RESTRM W/IND	L9486L 06A L583-363 L583-375	626AM	SCH
1	EA	MORTISE CYLINDER	30-022 138	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
1	EA	SURFACE CLOSER	4041T DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-07

Openings

A103A A103B A118A A217A B121A B209A
C107A C108A C124A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CORRIDOR LOCK	L9456L 06A L583-363 L283-722	626AM	SCH
1	EA	MORTISE CYLINDER	30-022 138	626	SCH
1	EA	SURFACE CLOSER	4040XPT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-08

Openings

A119A B114A C216A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-09

Openings

A121A C104D A216A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET # C-10

Openings

B100A B100B G006

Each door or doors to have:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR

ALL HARDWARE BY DOOR MFG

OPERATION: ACCESS CONTROL RELEASES DOOR AND ACTUATES MOTORED OPERATION.

HW SET # C-11

Openings

B103A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON 12/16/24/28 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4040XP EDA WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

OPERATION: ACCESS CONTROL RELEASES ELECTRIC STRIKE

HW SET # C-12

Openings

B106A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HW SET # C-13

Openings

B113A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	LD-98-NL	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
1	EA	ELECTRIC STRIKE	9600 FSE	630	HES
1	EA	SURFACE CLOSER	4040XP SCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	361AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
			ACCESS CONTROL - WORK OF DIVISION 28		
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		
			PROVIDE FACTORY POINT TO POINT DIAGRAMS		
			PROVIDE RISER DIAGRAMS		

120VAC TO POWER SUPPLY. COORDINATE WITH ELECTRICAL, ACCESS CONTROL, AND SECURITY SYSTEM CONTRACTOR.
VERIFY THRESHOLD DETAIL.

HW SET # C-14

Openings

B119A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON 12/16/24/28 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4041T DEL	689	LCN
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	WIRE HARNESS	CON-6W (FROM INCOMING POWER SUPPLY)		SCH
			ACCESS CONTROL - WORK OF DIVISION 28		
			DOOR CONTACT(S) - WORK OF DIVISION 28		
			POWER SUPPLY - WORK OF DIVISION 28		

COORDINATE WITH ELECTRICAL, ACCESS CONTROL, AND SECURITY SYSTEM CONTRACTOR.

HW SET # C-15

Openings

B123A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4041T DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS40 (INSTALL TOP OF DOOR)	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET # C-16

Openings

B131A B133A C217A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	ENTRANCE LOCK	ND53P6D RHO	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-17

Openings

B132A B212A B213A B216A B217A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA-Z49	AA	ZER

HW SET # C-18

Openings

B136A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
1	EA	ELECTRIC STRIKE	6211AL FSE CON 12/16/24/28 VAC/VDC	630	VON
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4041T DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA-Z49	AA	ZER
1	EA	WIRE HARNESS	CON-6W (FROM INCOMING POWER SUPPLY) ACCESS CONTROL - WORK OF DIVISION 28 DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL) POWER SUPPLY - WORK OF DIVISION 28		SCH

COORDINATE WITH ELECTRICAL, ACCESS CONTROL, AND SECURITY SYSTEM CONTRACTOR.

HW SET # C-19

Openings

B136B

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	INSTITUTION LOCK	ND82P6D RHO	626	SCH
1	EA	ELECTRIC STRIKE	6211AL FSE CON 12/16/24/28 VAC/VDC	630	VON
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4041T DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	WIRE HARNESS	CON-6W (FROM INCOMING POWER SUPPLY)		SCH
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		
			POWER SUPPLY - WORK OF DIVISION 28		

COORDINATE WITH ELECTRICAL, ACCESS CONTROL, AND SECURITY SYSTEM CONTRACTOR.

HW SET # C-20

Openings

A101A B101A C100A C102A C106A C106B

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 5 X 5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	LD-98-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-CON	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
2	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
2	EA	OH STOP	100S ADJ	630	GLY
2	EA	SURFACE CLOSER	4041 DEL EDA WMS	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61	689	LCN
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
1	EA	WIRE HARNESS	CON-26P VERIFY LENGTH (POWER TRANSFER TO ELECTRIFIED HARDWARE)		SCH
1	EA	WIRE HARNESS	CON-6W (FROM INCOMING POWER SUPPLY)		SCH
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK		VON
			ACCESS CONTROL - WORK OF DIVISION 28		
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		
			PROVIDE FACTORY POINT TO POINT DIAGRAMS		
			PROVIDE RISER DIAGRAMS		
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

120VAC TO POWER SUPPLY. COORDINATE WITH ELECTRICAL, ACCESS CONTROL, AND SECURITY SYSTEM CONTRACTOR.
VERIFY THRESHOLD DETAIL

HW SET # C-21

Openings

C106D

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	CDSI-98-NL	626	VON
1	EA	PANIC HARDWARE	LD-98-EO	626	VON
1	EA	MULLION STORAGE KIT	MT54 (WALL BACKING REQ'D)	689	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
3	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
1	EA	OH STOP	100S ADJ (LHR LEAF)	630	GLY
2	EA	SURFACE CLOSER	4041 DEL SCUSH WMS	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		

HW SET # C-22

Openings

C104B C104C

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	SURFACE CLOSER	4041 DEL EDA WMS	689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		
			WEATHERSTRIP BY DOOR/FRAME MANUFACTURER		

VERIFY THRESHOLD DETAIL

HW SET # C-23

Openings

C112A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458 TOP ONLY	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
2	EA	OH STOP	90S	630	GLY
2	EA	KICK PLATE	8400 24" X 1" LDW B-CS	630	IVE
1	EA	ASTRAGAL	43SP	SP	ZER
2	EA	SILENCER	SR64	GRY	IVE

HW SET # C-24

Openings

C113A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
1	EA	SURFACE CLOSER	4041 DEL SCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		

VERIFY THRESHOLD DETAIL

HW SET # C-25

Openings

C114A C117B

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON 12/16/24/28 VAC/VDC	630	VON
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	SURFACE CLOSER	4041 DEL SCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
1	EA	WIRE HARNESS	CON-6W (FROM INCOMING POWER SUPPLY)		SCH
			ACCESS CONTROL - WORK OF DIVISION 28		
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		
			POWER SUPPLY - WORK OF DIVISION 28		

COORDINATE WITH ELECTRICAL, ACCESS CONTROL, AND SECURITY SYSTEM CONTRACTOR.
VERIFY THRESHOLD DETAIL

HW SET # C-26

Openings

C114B

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 5 X 4.5 NRP	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458 TOP ONLY	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	EXIT X BLANK OUTSIDE	ND25D RHO	626	SCH
2	EA	SURFACE CLOSER	4041 DEL SCUSH WMS	689	LCN
2	EA	KICK PLATE	8400 24" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	ASTRAGAL	43SP	SP	ZER
2	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		

VERIFY THRESHOLD DETAIL

HW SET # C-27

Openings

C118C

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON 12/16/24/28 VAC/VDC	630	VON
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	SURFACE CLOSER	4041 DEL SHCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
1	EA	WIRE HARNESS	CON-6W (FROM INCOMING POWER SUPPLY) ACCESS CONTROL - WORK OF DIVISION 28 DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL) POWER SUPPLY - WORK OF DIVISION 28		SCH

COORDINATE WITH ELECTRICAL, ACCESS CONTROL, AND SECURITY SYSTEM CONTRACTOR.
VERIFY THRESHOLD DETAIL

HW SET # C-28

Openings

C118D C118E

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH

VERIFY CYLINDER TYPE, TAILPIECE, AND TYPE
ALL OTHER HARDWARE BY DOOR SUPPLIER

HW SET # C-29

Openings

C117A C117C C119A C126A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	361AA	AA	ZER

HW SET # C-30

Openings

C122A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
1	EA	ELECTRIC STRIKE	9600 FSE	630	HES
1	EA	SURFACE CLOSER	4041 DEL SCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	SECURITY ASTRAGAL	43STST	STST	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	103A-223	A	ZER
1	EA	WIRE HARNESS	CON-6W (FROM INCOMING POWER SUPPLY) ACCESS CONTROL - WORK OF DIVISION 28 DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL) PROVIDE FACTORY POINT TO POINT DIAGRAMS PROVIDE RISER DIAGRAMS		SCH

COORDINATE WITH ELECTRICAL, ACCESS CONTROL, AND SECURITY SYSTEM CONTRACTOR. VERIFY THRESHOLD DETAIL

HW SET # C-31

Openings

B214A B219A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-32

Openings

A218A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP WMS	689	LCN
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-33

Openings

B206A B206B

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	CDSI-98-NL	626	VON
1	EA	PANIC HARDWARE	LD-98-EO	626	VON
1	EA	MULLION STORAGE KIT	MT54 (WALL BACKING REQ'D)	689	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX 36-083	626	SCH
3	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
2	EA	SURFACE CLOSER	4041 DEL EDA WMS	689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA	689	LCN
2	EA	BLADE STOP SPACER	4040XP-61	689	LCN
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1			PERIMETER SEALS BY FRAME MANUFACTURER		

HW SET # C-34

Openings

B218A C128A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL VESTIBULE LOCK	ND93P6D RHO XN12-035	626	SCH
1	EA	SURFACE CLOSER	4041T DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-35

Openings

C209A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	LD-98-L-BE-06	626	VON
1	EA	SURFACE CLOSER	4041 DEL EDA WMS	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-36

Openings

C211A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL VESTIBULE LOCK	ND93P6D RHO XN12-035	626	SCH
1	EA	SURFACE CLOSER	4041T DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS40 (INSTALL TOP OF DOOR)	626	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER
3	EA	GASKETING	770AA 3068	AA	ZER
1	EA	DOOR BOTTOM	361AA	AA	ZER
1	EA	THRESHOLD	545A-223	A	ZER

VERIFY THRESHOLD DETAIL

HW SET # C-37

Openings

C105A C218A C218B C218C

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	MANUAL FLUSH BOLT	FB458 TOP ONLY	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ENTRANCE LOCK	ND53P6D RHO	626	SCH
2	EA	OH STOP	90S	630	GLY
1	EA	ASTRAGAL	43SP	SP	ZER
2	EA	SILENCER	SR64	GRY	IVE

HW SET # C-38

Openings

A301A B301A B301B C121A C301A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
1	EA	LOCK GUARD	LG14	630	IVE
1	EA	SURFACE CLOSER	4041 DEL SCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	566A-223	A	ZER

VERIFY THRESHOLD DETAIL

HW SET # C-39

Openings

B117A B126A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CORRIDOR LOCK	L9456L 06A L583-363 L283-722	626AM	SCH
1	EA	MORTISE CYLINDER	30-022 138	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-40

Openings

C118B

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4041 DEL SHCUSH WMS	689	LCN
1	EA	KICK PLATE	8400 24" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER

HW SET # C-41

Openings

B221A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL VESTIBULE LOCK	ND93P6D RHO XN12-035	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	369AA-Z49	AA	ZER

HW SET # C-42

Openings

G002 G004 G005 G007

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	GATE HINGE	DINO HINGE	689	LOC
1	EA	PANIC HARDWARE	LD-98-NL-WH	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4040XP SCUSH SRI WMS	689	LCN
			BALANCE OF HARDWARE BY GATE MANUFACTURER		

GATE MANUFACTURER TO PROVIDE MOUNTING BOXES/REINFORCEMENT AS NECESSARY FOR INSTALLATION OF SPECIFIED HARDWARE. COORDINATE HARDWARE WITH GATE MANUFACTURER AND CONFIRM THE SPECIFIED HARDWARE CAN BE INCORPORATED. INSTALL ANGLES ON GATE POSTS FOR INSTALLATION OF HINGES/CLOSER.

HW SET # C-43

Openings

A101B

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HWBSC 5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	PANIC HARDWARE	LD-9827-EO-LBR	626	VON
1	EA	PANIC HARDWARE	LD-9827-L-LBR-QM996-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
2	EA	SURFACE CLOSER	4041 DEL EDA WMS	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	MAG HOLDER	999M	689	RIX
2	EA	SILENCER	SR64	GRY	IVE

WALL MAGNETS REQUIRE SOLID SURFACE TO MOUNT.
CONTROLLED BY SECURITY SYSTEM.
FAIL SAFE ELECTRIC TRIM TO UNLOCK BY TIME CLOCK
FIRE ALARM. LOCKED BY LOCKDOWN SWITCH.

HW SET # C-44

Openings

C118A

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	VANDL STOREROOM LOCK	ND96P6D RHO	626	SCH
1	EA	SURFACE CLOSER	4041T DEL	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS40 (INSTALL TOP OF DOOR)	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
			DOOR CONTACT(S) - WORK OF DIVISION 28 (PROVIDE DOOR/FRAME PREP-COORDINATE WITH ELECTRICAL)		

HW SET # C-45

Openings

G001 G003

Each door or doors to have:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	GATE HINGE	DINO HINGE	689	LOC
1	EA	FIRE RATED REMOVABLE MULLION	KR9954 STAB	689	VON
1	EA	PANIC HARDWARE	LD-98-EO-WH	630	VON
1	EA	PANIC HARDWARE	LD-98-NL-WH	630	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	20-061 COORDINATE KEYWAY WITH DISTRICT	626	SCH
1	EA	FSIC CORE	23-030 (COORDINATE KEYWAY WITH DISTRICT)	626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC	630	VON
2	EA	SURFACE CLOSER	4040XP SCUSH SRI WMS	689	LCN
2	EA	WIRE HARNESS	CON-26P VERIFY LENGTH (POWER TRANSFER TO ELECTRIFIED HARDWARE)		SCH
2	EA	WIRE HARNESS	CON-6W (FROM INCOMING POWER SUPPLY)		SCH
			BALANCE OF HARDWARE BY GATE MANUFACTURER		

GATE MANUFACTURER TO PROVIDE MOUNTING BOXES/REINFORCEMENT AS NECESSARY FOR INSTALLATION OF SPECIFIED HARDWARE. COORDINATE HARDWARE WITH GATE MANUFACTURER AND CONFIRM THE SPECIFIED HARDWARE CAN BE INCORPORATED. INSTALL ANGLES ON GATE POSTS FOR INSTALLATION OF HINGES/CLOSER.
HARNESS FOR CONNECTION AT TOP OF MULLION

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Laminated glass interlayers.

D. Glazing compounds.

E. Work covered by this section is subject to Alternate No. 2 Community Based Bidding (CBB) Program. The applicable CBB criteria is included at the end of this specification section.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 06 4100 - Architectural Wood Casework: Cabinets with requirements for glass shelves and /or doors.

C. Section 08 1113 - HOLLOW METAL DOORS AND FRAMES: Glazed lites in doors and borrowed lites.

D. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

E. Section 08 4229 - Automatic Entrances: Glazing provided as part of door assembly.

F. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

G. Section 08 8723 - Decorative Glazing Films: Films applied to Glazing of this section.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

M. GANA (GM) - GANA Glazing Manual; 2008.

N. GANA (SM) - GANA Sealant Manual; 2008.

O. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

P. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

Q. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.

R. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).

S. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the 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 at least three years documented experience.

1.06 MOCK-UPS

A. Incorporate work of this section into the Integrated Exterior mock-up. See Section 01 4000 Quality Requirements.

B. Locate where directed.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. AGC Glass North America, Inc: www.agcglass.com.
   2. Cardinal Glass Industries: www.cardinalcorp.com.
   3. Guardian Glass, LLC: www.guardianglass.com.
   4. Pilkington North America Inc: www.pilkington.com/na.
   5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
   6. Hartung Glass.

7. Oldcastle BE
8. Substitutions: See Section 01 6000 - Product Requirements.

B. Laminated Glass Manufacturers:
1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
2. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com.
3. Hartung Glass.
4. Oldcastle BE.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Design Pressure: Calculated in accordance with ASCE 7.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
5. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Pr4ovide float glass based glazing unless otherwise indicated.
1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.04 INSULATING GLASS UNITS

A. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Low-e coating: Solarban 70 Solar Control Low-e coating.
4. Metal Edge Spacers: Aluminum, bent and soldered corners.
5. Spacer Color: Black.
6. Edge Seal:

a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
b. Color: Black.

7. Purge interpane space with dry air, hermetically sealed.

C. Type CG-1 - Insulating Glass Units: Vision glass, double-glazed, tempered.
1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Vitro Solargray.
b. Coating: Low-E (solar control type), on #2 surface.
4. Metal edge spacer.
5. Inboard Lite: Virto Starphire, Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
6. Total Thickness: 1 inch.
7. Thermal Transmittance (U-Value): 0.28, nominal.
8. Visible Light Transmittance (VLT): 32 percent, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.19, nominal.
10. Visible Light Reflectance, Outside: 7 percent, nominal.
11. Glazing Method: Dry glazing method, gasket glazing.

D. Type CG-2 - Insulating Glass Units: Vision glass, double-glazed, laminated.
1. Applications: Exterior glazing as indicated on drawings. Automatic Entrances.
2. Space between lites filled with air.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
a. Tint: Vitro Solargray.
b. Coating: Low-E (solar control type), on #2 surface.
4. Metal edge spacer.
5. Inboard Lite: Virto Starphire, Laminated float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
6. Total Thickness: 1 inch.
7. Thermal Transmittance (U-Value): 0.28, nominal.
8. Visible Light Transmittance (VLT): 32 percent, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.19, nominal.
10. Visible Light Reflectance, Outside: 7 percent, nominal.
11. Glazing Method: Dry glazing method, gasket glazing.

2.05 GLAZING UNITS

A. Type G-1 - Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 3/8 inch, nominal, minimum.

B. Type G-2 - Not Used

C. Type G-3 - Laminated Security Glazing, 2-Ply.
1. Applications: Glazing in opening C106D and locations as indicated on drawings.
2. Tint: Clear.
3. Thickness: 1/2 inch, nominal.
4. Outer Lite: Tempered glass.
5. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
6. Inside Lite: Tempered glass.

D. Type G-4 - Monolithic Display Glazing:
1. Applications: Sliding doors of display cases and locations as indicated on drawings.
2. Tint: Clear.

3. Glass Type: Fully tempered float glass with ground edges and corners where exposed; ASTM C1048.
4. Thickness: 3/8 inch, nominal.

2.06 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

D. And as recommened by the galzing manufacturer for specific applications.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

E. Place glazing tape on free perimeter of glazing in same manner described above.

F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

G. Carefully trim protruding tape with knife.

3.06 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.08 COMMUNITY BASED BIDDING (CBB) DOCUMENTATION

A. Submit affidavits, checklists, reports and documentation, monthly or as otherwise defined, in accordance with the Owner’s CBB criteria which follows this specification section.

END OF SECTION 08 8000

SECTION 08 8723

DECORATIVE GLAZING FILMS

PART 1 - GENERAL

1.01 SUMMARY

A. Decorative Glazing Films.

1.02 REFERENCE STANDARDS

A. ASTM E-84, "Test Method for Surface Burning Characteristics of Building Materials".

B. ASTM E 903, "Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres."

C. ASTM D 3330, "Standard Test Methods for Peel-Adhesion at 180 Degree Angle".

1.03 PERFORMANCE REQUIREMENTS

A. Thermal and Optical Performance Properties: Provide glazing films with performance properties specified (on 1/8 inch clear glass) based on manufacturer's published test data, as determined according to procedures indicated in ASHRAE Handbook of Fundamentals:
   1. Performance requirements vary by product selected and will be identified by Architect from color selection samples submitted by the manufacturer.

B. Surface Burning Characteristics: Provide films that have Flame Spread Index of 0 and Smoke Development Index of 30 or less when tested in accordance to ASTM E 84.

C. Minimum Peel Strength: 2,000 grams per inch, average of two specimens when tested in accordance with ASTM D 3330.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Samples for Color Selection: Manufacturer's standard sample sets showing the full range of colors available for each type of product indicated.

C. Samples for Verification: 12-inch square samples of each glazing film, of each product color specified.

D. Closeout Submittals: Upon completion of the Work, submit the following;
   1. Executed warranty.
   2. Maintenance (cleaning) and replacement instructions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a firm experienced in manufacturing systems similar to those indicated for this Project and meeting the standards of the International Standards Organization (ISO), ISO 9001 Quality Assurance in Production and Installation.

B. Installer Qualifications: Engage an experienced installer certified, licensed, or otherwise qualified by film manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements.

C. Mockups: Apply glazing films in locations as directed to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
   1. Obtain approval of field samples before continuing with remainder of installation.
   2. Maintain field samples during remainder of installation in an undisturbed condition as a standard for judging the completed Work.
   3. Approved field samples may become part of the completed Work.

D. Pre-installation Conference: Before installing glazing films, conduct conference at Project site. Conduct pre-installation conference in conjunction with installation of mockup.
   1. Meet with Owner, Architect, glazing film Installer and glazing film manufacturer's representative.
   2. Review methods and procedures related to installation, including manufacturer's written instructions.

3. Examine substrate conditions for compliance with requirements.
4. Review temporary protection measures required during and after installation.
5. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing films according to manufacturer's written instructions and as needed to prevent damage condensation, temperature changes, direct exposure to sun, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with film installation when ambient and substrate temperature conditions are outside limits permitted by manufacturer and when glass substrates are wet from frost, condensation, or other causes.

1.08 WARRANTY

A. Manufacturer's Warranty: Fully executed warranty, written in favor of the Owner, agreeing to replace films that deteriorate as defined in "Definitions" Article, within 5 years from date of original installation.

PART 2 - PRODUCTS

2.01 GLAZING FILM

A. Manufacturers:
   1. Solyx Films: www.solyxfilms.com
   2. 3M Window Film: www.3m.com/us/arch_construct/scpd/windowfilm
   3. CPFilms, Inc: www.cpfindusprod.com www.cpfindusprod.com
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Product Description: Single or multi-layered decorative film products, applied to interior glass surfaces, consisting of from outboard surface to inboard surface:
   1. Similar to "Fasara, Mat Crystal-1", by 3M.
   2. Shading coefficient: 0.94.
   3. VLT: 85%.
   4. Roll size: 50 inches wide.

2.02 GLAZING FILM ACCESSORIES

A. General: Provide products complying with requirements of glazing film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Adhesive: Pressure Sensitive acrylic adhesive system, compliant with project's VOC requirements.

C. Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine glass and surrounding adjacent surfaces for conditions affecting installation.
   1. Report conditions that may adversely effect installation. In report, include description of any glass that is broken, chipped, cracked, abraded, or damaged in any way.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Immediately before beginning installation of films, clean glass surfaces of substances that could impair glazing film's bond, including mold, mildew, oil, grease, dirt and other foreign materials.

C. Protect window frames and surrounding conditions from damage during installation.

3.03 INSTALLATION

A. General: Comply with glazing film manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
   1. Install film continuously, but not necessarily in one continuous length. Install with no gaps or overlaps.
   2. If seamed, install with no gaps or overlaps. Install seams vertical and plumb. No horizontal seams allowed.
   3. Do not remove release liner from film until just before each piece of film is cut and ready for installation.
   4. Install film with mounting solution and custom cut to the glass with neat, square corners and edges to within 1/8 inch of the window frame.
   5. Remove air bubbles, wrinkles, blisters, and other defects.

B. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, banding, thin spots or pinholes.
   1. If installed film does not meet this criteria, remove and replace with new film.

3.04 CLEANING

A. Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended by glazing film manufacturer.

C. Replace films that cannot be cleaned.

END OF SECTION 08 8723

SECTION 08 9100

LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 2001 - Masonry Veneer: adjacent wall assembly

B. Section 07 4213 - Metal Wall Panels, adjacent wall material.

C. Section 07 6200 - Sheet Metal Flashing and Trim.

D. Section 09 9113 - Exterior Painting: Field painting.

E. Section 23 3101 - HVAC Ducts and Casing - Low Pressure

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

B. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

1. Test data indicating Class A performance at stated wind speed and rainfall performance requirements.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall Louvers:

1. Airolite Company, LLC: www.airolite.com.
2. Construction Specialties: cs-group.com
3. Pottorff: www.pottorff.com.
4. Ruskin: www.ruskin.com.
5. Greenheck: www.greenheck.com
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers at Masonry Veneer: Horizontal blade, extruded aluminum construction, with intermediate mullions matching frame.

1. Free Area: 50 percent, minimum.
2. Blades: V-shaped, sight-proof.

3. Frame: 6 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
4. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.
5. Aluminum Finish: Powder coat, 100% resin flourpolymer coating, 1.5 to 3 mil thick; finish welded units after fabrication. Meet or exceed requirements of AAMA 2605-5.
6. Color: Custom color as shown on Drawings.
7. Basis of Design: Greenheck EHH-601 series

C. Stationary Louvers at Metal Wall Panels and Phenolic Wall Panels: Vertical blade, extruded aluminum construction.
1. Free Area: 50 percent, minimum.
2. Blades: V-shaped, 3 inch by 3 inch legs, sight-proof.
3. Frame: 6 inches deep, channel profile; corner joints mitered.
   a. Mounting Type: As indicated on drawings.
4. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.
5. Aluminum Finish: Mill finish; finsih welded units after fabrication.
6. Color: Custom color as shown on Drawings.
7. Basis of Design: Greenheck EVH-602 series

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063-T5 Alloy.

2.04 FINISHES

A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.

B. Primer: Zinc chromate, alkyd type, or as recommended by manufacturer for compatibility with top coat system specified.

C. Color: As indicated on drawings.

2.05 ACCESSORIES

A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 2 inch thick where space allows, 1 inch thick elsewhere, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.Thermal insulation value R-5 and R-10.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch diameter wire, 1/2 inch open weave, diagonal design.

D. Insect Screen: 18 x 16 size aluminum mesh.

E. Fasteners and Anchors: Stainless steel.

F. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

G. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

E. Coordinate with installation of mechanical ductwork.

F. Seal between louver, mechanical duct, and blank-off panel for air and water-tight construction.

3.02 ADJUSTING

A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.03 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION 08 9100

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Metal channel ceiling framing.

C. Acoustic insulation.

D. Gypsum wallboard.

E. Glass-mat faced gypsum sheathing board.

F. Joint treatment and accessories.

G. Acoustical sealant.

H. Textured finish system.

I. Work covered by this section is subject to Alternate No. 2 Community Based Bidding (CBB) Program. The applicable CBB criteria is included at the end of this specification section.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Integrated Exterior Mockup.

B. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.

C. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

D. Section 07 4113 - Metal Roof Panels: Gypsum deck sheathing under roofing

E. Section 07 5400 Thermoplastic Membrane Roofing: Gypsum deck sheathing under roofing

F. Section 07 8400 - Firestopping: At fire-resistance-rated wall assemblies.

G. Section 09 2216 - Non-Structural Metal Framing.

H. Section 09 3000 - Tiling: Cementitious backing board for Tiling.

I. Section 09 9600 - Painting: PVA primer/sealer on gypsum board.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

G. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

H. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.

I. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2018.

J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2018.

K. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.

L. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

M. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.

N. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

O. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.

P. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019.

Q. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

S. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

T. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

U. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

V. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2016.

W. OSSC - Oregon Structural Specialty Code; latest edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Test Reports: For fire rated materials. Indicate specific test reports for each rated assembly.

D. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.

1.05 MOCK-UPS

A. Integrated Exterior Mock-ups: Provide exterior sheathing for integrated exterior mock-up as specified in Section 01 4000 - Quality Requirements.

B. Partial Interior Mock-ups: Before beginning gypsum board installation, install mock-ups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mock-ups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mock-ups.
   3. Simulate finished lighting conditions for review of mock-ups.
   4. Approved mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. 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.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of documented experience.

PART 2 PRODUCTS

2.01 METAL FRAMING MATERIALS

A. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Studs: C-shaped with knurled or embossed faces, 20ga minimum.
   2. Jambs: Double 20ga C-shaped studs, minimum.
   3. Runners: U-shaped, sized to match studs.
   4. Ceiling Channels: C-shaped.
   5. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
   6. Resilient Furring Channels: Single leg configuration; 1/2 inch channel depth.
      a. Resilient channels shall be of flat, 24 to 26 gage sheet metal constructed with a 1-1/4 inch to 2-1/2 inch wide screw flange on one side and a 1/2 inch to 3/4 inch screw flange on the other side separated by a slotted metal bridge. Slots in bridge shall be 2-1/2 inch to 3-1/4 inch long and 0.25 inch to 0.32 inch wide and installed along the bridge on 3-1/2 inch to 4 inch center spacings.
      b. Configuration: Asymmetrical.

B. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated on Drawings or as required to support wall-attached elements specified elsewhere.
   1. Minimum Base-Metal Thickness: 0.0312 inch (20 gage), unless otherwise indicated.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

D. Preformed Top Track Firestop Seal:
   1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems of fire rating and movement required.

E. Non-structural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
      a. Materials: ASTM A653 sheet steel formed into support member with factory-welded ASTM A1003/A1003M steel plate base.
      b. Height: 34 inches.
      c. Products:
         1) SCAFCO PonyWall Support: https://www.scafco.com/steel/products/ponywall-support/.
         2) Substitutions: See Section 01 6000 - Product Requirements.

F. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire and braced as required by code.

G. Load-bearing Studs for Application of Gypsum Board: As specified in Section 05 4000.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum: www.americangypsum.com.
   2. Celotex.
   3. CertainTeed Corporation: www.certainteed.com.
   4. Domtar Gypsum America, Inc.
   5. Georgia-Pacific Gypsum: www.gpgypsum.com.
   6. National Gypsum Company: www.nationalgypsum.com.
   7. PABCO Gypsum: www.pabcogypsum.com.
   8. Temple-Inland Building Product by Georgia-Pacific, LLC: www.temple.com.
   9. USG Corporation: www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces, unless otherwise indicated.
   2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
   3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 1/2 inch.
      c. Curved surfaces: Multiple layers of 1/4 inch thickness for a minimum overall thickness of 1/2 inch unless otherwise indicated on drawings.
      d. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
   5. Edges: Tapered

C. Impact Resistant Wallboard:
   1. Application: All exposed gypsum wallboard locations 4' and below that do not receive wainscoting will receive impact resistant wallboard.
   2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
   6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   7. Type: Fire-resistance-rated Type X, UL or WH listed.
   8. Thickness: 5/8 inch.
   9. Edges: Tapered.
   10. Paper-Faced Products:
      a. American Gypsum Company; M-Bloc IR Type X: www.americangypsum.com/#sle.
      b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech: www.certainteed.com/#sle.
      c. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board: www.nationalgypsum.com/#sle.
      d. USG Corporation; USG Sheetrock Brand Mold Tough VHI Firecode X Panels: www.usg.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

D. Water-Resistant Gypsum Backing Board: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces on all walls in wet areas such as restrooms, and within 4 feet of pluimbing fixtures in all other areas..
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. Type: Regular and Type X, in locations indicated.
4. Type X Thickness: 5/8 inch.
5. Regular Board Thickness: 5/8 inch.
6. Edges: Tapered.

E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch.
3. Edges: Tapered.

F. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
3. Core Type: Type X, as indicated.
4. Type X Thickness: 5/8 inch.
5. Edges: Square.
6. Glass Mat Faced Products:
   a. CertainTeed Corporation; GlasRoc Brand.
   b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com.
   c. National Gypsum Company; Gold Bond eXP Sheathing: www.nationalgypsum.com.
   d. Temple-Inland Building Products by Georgia-Pacific, LLC; GreenGlass Exterior Sheathing.
   e. Substitutions: See Section 01 6000 - Product Requirements.

G. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Paper-Faced Products:
   a. CertainTeed Corporation; M2Tech Type X Shaftliner: www.certainteed.com/#sle.
   b. Georgia-Pacific Gypsum; ToughRock Shaftliner: www.gpgypsum.com/#sle.
   c. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP: www.nationalgypsum.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.

H. Deck Sheathing: As specified in sections 07 4113 Metal Roof Panels and 07 5400 Thermoplastic Membrane Roofing

2.03 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3-1/2 inch.
1. Certified by the Greenguard Environmental Institute under the Greenguard Standard for Low Emitting Products.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant meeting project's VOC limits; do not use solvent-based non-curing butyl sealant.

C. Acoustic Sealant: Paintable, non-hardening sealant per section 07 9005 Joint Sealants.

D. Acoustical Framing Accessories:
1. Resilient Furring Channels: ASTM C645; galvanized sheet steel, 1/2 inch depth, for attachment to substrate through one leg only.
   a. Products:
      1) ClarkDietrich RC Deluxe
      2) Cemco RC-1XD
      3) No substitutions.

E. Weather Barrier: As specified in Section 07 2500.

F. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

G. Reveals and Moldings:
   1. Expansion and Control Joints: Aluminum, similar to Fry Reglet DRM-50-50 2 piece.
   2. Reveal Moldings:
      a. Quarter Inch: Aluminum, 5/8 inch deep, 1/4 inch wide, similar to Fry Reglet DRM 625-25
      b. Half Inch: Aluminum, 5/8 inch deep, 1/2 inch wide, similar to Fry Reglet DRM 625-50.
      c. One inch: Aluminum, 5/8 inch deep, 1 inch wide, similar to Gordon, Inc. # RD-5810.
      d. "F" Reveal: Aluminum, 5/8 inch deep, 1/2 inch wide, similar to Fry Reglet FDM-625-50.
   3. Indirect Light Edge Cove for Curved Drywall:
      a. Basis of Design: Armstrong Axiom ALLICUR
      b. Substitutions: See Section 01 6000 - Product Requirements.
      c. Application: Curved ceiling in Cafeteria and as shown on Drawings.
      d. Curved radius: As shown on Drawings.

H. Control Joint: One piece control joint formed from rolled zinc with V-shaped slot and removable. strip covering slot opening

I. Partition Closure: Aluminum closure to transition between windows and partition walls.
   1. Product: Mullion Mate 3 by Gordon Inc. - www.gordon-inc.com
   2. Finish: Clear anodized
   3. Acoustical Rating: STC 38
   4. Accessory: Series 911-EC-375 Final Forms 1, wall end plate
   5. Size: As required for span opening of 2 7/8 inch to 3 15/16 inch

J. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Joint Compound: Setting type, field-mixed.

K. Textured Finish Materials: Latex-based compound; plain.
   1. Basis of Design Product:
      a. Sheetrock Brand Wall and Ceiling Spray Texture manufactured by USG Corporation.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. Primer: Flat latex primer. Primer is in addition to primers specified in Section 09 90 00 - Painting and Coating.

L. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

M. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

N. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.
   1. Similar to "SA-8", or "SP-8B" by The Solar Group, "CSV-8" by NorWesCo.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.
   3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

E. See Structural Drawings for limitations on attachment methods to Buckling-Restrained-Braces.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Resilient Channels - install per manufacturer's installation instructions.
   1. Provide at 24' oc; install horizontally, Locate joints over framing members.

B. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Maintain minimum 1/4-inch gap around the perimeter of acoustic walls, and at annual spaces around penetrations to allow for installation of acoustic sealants.
   4. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Continuous substrate:
      a. Existing substrate must be continuous and secured prior to application of air barrier.
      b. Securely fasten sheathing panels and install flush to ensure a continuous substrate in accordance with Air Barrier Manufacturer's installation guide and as specified in section 07 2500.
      c. Fastener penetrations must be set flush with sheathing and fastened into solid backing.
   2.

F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

E. Reveal Moulding: Install in patterns as shown on drawings according to manufacturer's instructions, directly to wall framing, or base layer of wall board in multiple layer applications. Cutting in reveal molding after wall board installation is not acceptable.

F. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

G. Wall and Ceiling Mounted Access Hatches: Coordinate size, location and number of access hatches shown to be provided in other specification sections or on the drawings. Install these access hatches in gypsum board walls and ceilings in accordance with manufacturer's instructions flat and smooth in wall and ceiling surfaces.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 3: Walls to receive textured wall finish.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.08 TEXTURE FINISH

A. Coordinate application of paint primer by Section 09 9000 over gypsum board after taping, filling, and sanding, but prior to texture application.

B. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

C. Texture Required: Light fog-and-splatter.

SECTION 09 3000

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Ceramic accessories.

E. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-In-Place Concrete: Floor substrate.

B. Section 09 2116 - Gypsum Board Assemblies: Interior Metal wall framing.

C. Section 22 4000 - Plumbing Fixtures: Floor Drains.

1.03 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2017.

B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 2017.

C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2016).

D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017.

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2016).

N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.

O. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).

P. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).

Q. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).

R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014.

S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2019.

T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018.

U. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).

V. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

W. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 square feet of T-1and T-2, and 1 box of each subsequent accent tile color.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
   1. Approved mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. American Olean Corporation: www.americanolean.com/#sle.
   2. Dal-Tile Corporation: www.daltile.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Glazed Wall Tile, Type T-2, T-3, T-4, T-5, T-6, T-7, T-8, T-9: ANSI A137.1, standard grade.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Size: __4__by__16__ inch, nominal.
   3. Thickness: 3/8 inch
   4. Surface Finish: Glossy.
   5. Color(s): As indicated on drawings.
   6. Pattern: As indicated on enlarged tile pattern drawings.
   7. Products:
      a. Color Story Wall by American Olean: www.americanolean.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

C. Glazed Wall Tile, Type T-10
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Size: 4 x 8 inch, nominal. Furnish Owner 350 tiles for creation of student artwork; final art tiles will be returned to Contractor for installation
   3. Thickness: 5/16 inch
   4. Surface Finish: Matte
   5. Color: As indicated on drawings.
   6. Pattern: As indicated on Cafeteria Interior Elevations.
   7. Product:
      a. Color Wheel Collection - Linear by Dal-Tile Corporation: www.daltile.com/#sle.

D. Quarry Tile, Type T-1: ANSI A137.1, standard grade.
   1. Moisture Absorption: Over 3.0 but not more than 5.0 percent as tested in accordance with ASTM C373.
   2. Size: 6 by 6 inch, nominal.
   3. Thickness: 1/2 inch, nominal.
   4. Surface Finish: Non - abrasive.
   5. Color(s): As indicated on drawings.
   6. Trim Units: Matching cove and cove base shapes in sizes coordinated with field tile.
   7. Products:
      a. Quarry Textures by Dal-Tile Corporation: www.daltile.com/#sle.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile: similar to Schluter - QUADEC
      b. Transition between floor finishes of different heights: similar to Schluter - RENO-TK.
      c. Expansion and control joints, floor and wall: similar to Schluter - DECO.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com/#sle.
      b. Profilitec: www.profilitec.com
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
   2. Products:
      a. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
      b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
      c. LATICRETE International, Inc: www.laticrete.com/#sle.
      d. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Color(s): As indicated on drawings.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX WA: www.ardexamericas.com/#sle.
      b. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
      c. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
      d. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
   1. Applications: Between tile and plumbing fixtures.
   2. Color(s): As selected by Architect from manufacturer's full line.
   3. Products:
      a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
      b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
      c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.
   2. Products:
      a. Merkrete, by Parex USA, Inc; _____: www.merkrete.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch gap, minimum.
   2. Thickness: 20 mils, maximum.
   3. Products:
      a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
      b. Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
   1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
   2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Space control joints at 12 foot to 16 foot intervals in each direction, unless otherwise indicated
   3. Provide joints at perimeter walls and at fixtures or structural elements.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

M. Install grout sealer at grout joints of porcelain tile per tile and grout manufacturer's instructions.

N. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Use epoxy grout at kitchen. Over Interior concrete substrates, install in accordance with TCNA (HB) Method F115, with Epoxy grout.
   1. Where waterproofing membrane is indicated, install in accordance with The Tile Council of North America Handbook Method F122 except with epoxy grout.
   2. Locations of Waterproofing Use: Kitchen floor.
   3. Where crack isolation membrane is indicated, install in accordance with The Tile Council of North America Handbook Method F125 (full) except with epoxy grout.

3.05 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation, unless otherwise approved by manufacturer. Protect tile during curing process as recommended by manufacturer.

END OF SECTION 09 3000

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units for lay-in application.

C. Acoustical units for cloud applications.

D. Work covered by this section is subject to Alternate No. 2 Community Based Bidding (CBB) Program. The applicable CBB criteria is included at the end of this specification section.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 08 3100 - Access Doors and Panels: Access panels.

C. Section 09 2116 - Gypsum Board Assemblies: Adjacent ceilings, bulkheads, and walls.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

E. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

F. Section 27 5116 - Public Address Systems: Speakers in ceiling system.

G. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASCE 7-10 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers; current edition.

C. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.

D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.

F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2019.

G. NWCB TB 401 - Suspension Systems for Acoustical Lay-in Ceilings, Field Technical Information; Northwest Wall and Ceiling Bureau; 2009.

H. OSSC - Oregon Structural Specialty Code, current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components, acoustical units, and seismic restraint components.

C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and seismic restraint details.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: 10 unopened cases of ACT-1 tile, 1 unopened case of ACT-2 tile.
   3. Store where directed in un-opened cartons.

F. Regulatory Submittals (Deferred Permit Submittals): Submit design drawings, shop drawings, and calculations for seismic system sealed by a Professional Structural Engineer licensed in Oregon code authority for review and approval.

1.06 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit 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 three years' experience.

1.07 PERFORMANCE REQUIREMENTS

A. Suspension System: Rigidly secure ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

B. Seismic Standard: Provide acoustical ceiling system designed and installed to withstand effects of earthquake motions as follows:
   1. In accordance with ASCE 7, Seismic design category D, E or F.
   2. Seismic Restraint: ASTM E 580.
   3. Oregon Structural Specialty Code.

1.08 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Rockfon: www.rockfon.com/#sle.
   4. USG: www.usg.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.
   2. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustical Ceiling Clouds
   1. Armstrong World Industries, Inc., www.armstrong.com
   2. Product used for ceiling clouds as indicated on the Drawings.
   3. Substitutions: See Section 01 6000 - Product Requirements

D. Manufacturers listed are approved provided they can supply units that match specified tile pattern and texture to Architect's satisfaction.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panel Type ACT-1: Painted mineral fiber, ASTM E 1264 Type III, with the following characteristics:
   1. Size: 24 by 48 inches.
   2. Thickness: 5/8 inches.
   3. Composition: Wet felted.
   4. Light Reflectance: 0.85 percent, determined in accordance with ASTM E1264.
   5. NRC Range: 0.60 to 0.75, determined in accordance with ASTM E1264.
   6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   7. Edge: Square.
   8. Surface Color: White.
   9. Surface Pattern: Non-directional fissured.
   10. Suspension System: Exposed grid.
   11. Product: Ultima, Square Lay-in by Armstrong, Model #1913.
      a. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustical Panel Type ACT-2: Wet formed mineral fiber with acoustically transparent water-repellent membrane, ASTM E 1264 Type IV, with the following characteristics:
   1. Size: 24 x 48 inches.
   2. Thickness: 3/4 inches.
   3. Light Reflectance: 0.86 percent, determined as specified in ASTM E 1264.
   4. NRC Range: 0.55 to 0.70, determined as specified in ASTM E 1264.
   5. Fire Resistance: Approved for fire resistant assemblies.
   6. Edge: Square Lay-in.
   7. Surface Color: White.
   8. Surface Pattern: Non-directional fissured.
   9. Product: Ultima Health Zone by Armstrong Model #1938.
      a. Substitutions: See Section 01 6000 - Product Requirements

D. Acoustical Panel Type ACT-3: Painted mineral fiber, ASTM E 1264 Type III, with the following characteristics:
   1. Size: 24 x 48 inches.
   2. Thickness: 3/4 inches.
   3. Composition: Wet felted.
   4. Anti Mold/Mildew and Bacteria Treated
   5. No added Formaldehyde
   6. Light Reflectance: 0.81 percent, determined as specified in ASTM E 1264.
   7. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E 1264.
   8. NRC Range: 0.50 to 0.6, determined as specified in ASTM E 1264.
   9. Fire Resistance: Class A
   10. Fire Resistance Rating: One hour assembly
   11. Edge: 15/16" Angled Tegular.
   12. Surface Color: White.
   13. Surface Pattern: Fine Texture.
   14. Product: Dune Second Look II by Armstrong Model #2712.
      a. Substitutions: See Section 01 6000 - Product Requirements.

E. Acoustical Ceiling Clouds, Type ACC-1, ACC-2, ACC-3, ACC-4: Aspen wood fibers bonded with inorganic hydraulic cement .
   1. Size: As indicated on drawings
   2. Thickness: 2 inches.
   3. Panel Edge: Radius.
   4. Surface Pattern: Coarse.
   5. Surface Color: As indicated on drawings.
   6. Flame Spread: ASTM E 1264; (Fire Class)
   7. Light Reflectance (LR) White Panel: ASTM E 1477
   8. Products:

a. Tectum Shapes and or Clouds as manufactured by Armstrong World Industries, Inc; Tectum: www.armstrongceilings.com/#sle.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
   1. Application(s): Seismic.
   2. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   3. Profile: Tee; 15/16 inch face width.
   4. Finish: Baked enamel.
   5. Color: White.
   6. Locations: For use with ACT-1, ACT-2, ACT-3
   7. Product: Prelude by Armstrong

C. Suspension System for "Cloud" Applications:
   1. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A653. Main beams and cross tees are double-web steel construction with 15/16” type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
      a. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
      b. Color: Standard White
   2. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
   3. Wire for Hangers and Ties: ASTM A641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.
   4. Acceptable Product: Prelude XL 15/16” as manufactured by Armstrong World Industries

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
   1. Wire gauge: Minimum 12 gauge.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Powder-driven Anchors: When used for seismic restraint purposes, anchors to be ICC-ES approved for seismic applications.

D. Perimeter Trims: Same metal and finish as grid.
   1. Metal Edge Trim at curved openings:
      a. Product: AXIOM Classic Trim Curved
      b. Material: Extruded aluminum
      c. Dimensions:
         1) Height:16 inches
         2) Width: 3/4 inch
         3) Radius: as shown on the drawings. CAD files can be provided by Architect.

E. Accent Joints:Same metal and finish as grid.
   1. Assembly of:
      a. Channel Moulding: Hemmed wtih prefinsihed exposed flanges, similar to Armstrong #7830.
      b. Fascia Moulding: Prefinished exposed flanges, similar to Armstrong #7814.

c. Fasten together in configuration shown on drawings and as recommended by grid manufacturer.

F. Perimeter Clips: Manufacturer's standard; approved for use in lieu of 2 inch wide perimeter molding.

G. Seismic ceiling joint trim or device: Manufacturer's standard providing 3/4 inch movement, matching grid.

H. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASCE 7-05, ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Provide seismic bracing as shown on drawings and as required by OSSC for Occupancy Category II, Seismic Design Category D. NWCB Technical Bulletin 401 may be used as a reference.
1. Secure grid system to two adjacent walls, provide 3/4 inch movement at opposite walls.
2. Utilize approved perimeter clips instead of 2 inch wide perimeter moldings.
3. Install seismic ceiling expansion joints where indicated on drawings to divide ceiling system areas to less than 2,500 square feet.
4. Install powder-driven anchors for seismic applications in accordance with ICC-ES approval and with special inspection.

D. Locate system on room axis according to reflected plan.

E. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Use longest practical lengths.

F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not allow hangers or bracing to obstruct parts of mechanical or electrical systems requiring maintenance.

I. Provide framing around any recessed lighting fixtures and other openings.

J. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

K. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

L. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

3.05 FIELD QUALITY CONTROL

A. An independent testing agency will perform Special Inspection for powder-driven shot-in anchors used as part of the seismic design, as specified in Section 01 1400.

3.06 CLEANING AND PROTECTION

A. Replace any damaged, chipped, scratched, or broken ceiling tile units identified up to the time of final completion. Use of sealant or putty patch material to conceal damage is not allowed.

3.07 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.08 COMMUNITY BASED BIDDING (CBB) DOCUMENTATION

A. Submit affidavits, checklists, reports and documentation, monthly or as otherwise defined, in accordance with the Owner's CBB criteria which follows this specification section.

END OF SECTION 09 5100

SECTION 09 5426
WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood ceiling panels.

B. Suspension grid.

C. Trim and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 2116 - Gypsum Board Assemblies: Adjacent ceilings, bulkheads, and walls.

C. Section 09 5100 - Acoustical Ceilings.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

E. Section 26 5000 - Lighting: Light fixtures in ceiling system

F. Section 27 5116 - Public Address Systems: Speakers in ceiling system.

G. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM A 641: Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire; 1992.

B. ASTM C 423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 1990.

C. ASTMC C 635: Standard Specifications for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

D. ASTM C 636: Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 1992.

E. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials; 1991.

F. ASTM E 580: Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint; 1991.

G. AWI (QSI): Architectural Woodwork Quality Standards Illustrated; 2003.

H. CISCA: Ceiling Systems Handbook.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in panel ceiling installation with minimum [5] years experience, and approved by wood ceiling manufacturer.

B. Single-Source Responsibility for Wood Ceiling System: Obtain each type of ceiling panel from a single fabricator, with in-house shop drawing capabilities, in-house assembly and finishing capabilities, and with resources to provide products of consistent quality in appearance and physical properties without delaying the project.

C. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying project.

D. Pre-Installation Conference: Conduct conference at project site.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product specified.

C. Samples: For verification of each type of exposed finish required. Where finishes involve normal color and texture variations, include sample sets showing the range of variations expected.
   1. 12” x 18” samples of each panel type, pattern, and color.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Shop Drawings: Provide coordinated Shop Drawings to include reflected ceiling plan and product details. Coordinate layout and installation of wood panels and suspension system components with other construction elements that penetrate ceilings or are supported by them, including light fixtures, HVAC equipment, fire-suppression system components, partition assemblies and all perimeter conditions.

1.06 FIELD CONDITIONS

A. Do not install wood panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete, and ambient temperature and humidity conditions are being maintained at the levels indicated for Project when occupied for its intended use.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery & Unloading: Coordinate crate sizes, weights, unloading options, and delivery schedule with manufacturer prior to fabrication. Deliver wood panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other mistreatment.

B. Climatization: Before installing wood panels, permit them to reach room temperature and a stabilized moisture content (at least 72 hours) per AWI standards.

C. Handling: Handle Wood ceiling panels carefully to avoid chipping edges or damaging units in any way.

D. Protection:
   1. Personnel: Follow good safety and industrial hygiene practices during handling and installing of all products and systems, with personnel to take necessary precautions and wear appropriate protective equipment as needed. Read related literature for important information on products before installation. Contractor to be solely responsible for all personal safety issues during and subsequent to installation; architect, specifier, owner, and manufacturer will rely on contractor’s performance in such regard.
   2. Existing completed work: Protect completed work above suspension system from damage during installation of suspension system components.

1.08 EXTRA MATERIALS/WARRANTIES

A. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
   1. Wood ceiling panels: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
   2. Suspension System Components: Furnish quantity of each component equal to 2.0 percent of amount installed.

B. Warranties: Provide owner with a (1) year warranty for material and workmanship on all installed products.
   1. Manufacturers: All materials, wood ceiling and grid, shall be warranted for (1) one year for material and workmanship.
   2. Installer: All work shall be warranted for (1) year from date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. 9wood, Inc., www.9wood.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 WOOD CEILING PANELS

A. Basis of Design: 9Wood, Inc. Linear, Series 2000.
   1. Wood Panels:
      a. Species: Western Hemlock
      b. Member Size: Width x thickness, 5/8 inch x 3 1/4 inch
      c. Edge Profile: Square
      d. Members/LF: 3
      e. Assembly Style: Cross Piece backer (black)
      f. Panel Sizes: Nominal size, 12 inches wide; lengths per drawings.
      g. Fire Rating: Fire Rating Class, Class 1(A) Fire Rating
      h. Finish: Cherry Stain

2.03 SUSPENSION SYSTEMS

A. Metal T-grid Suspension System: ASTM C635, standard interior 15/16 inch heavy-duty metal suspension system using main runners, cross-tees, and wall angles, with "black" finishes as indicated. Comply with all applicable seismic codes and ordinances.

B. Attachment Devices: Size for 3 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire, Braces, Ties, Hanger Rods, Flat Hangers and Angle Hangers: Provide wires, rods and hangers that comply with applicable ASTM specifications.

2.04 ACOUSTICAL LINER

A. Semi-rigid acoustical board applied to upper surface of certain wood grid sections, above the black fabric, where shown on drawings.

B. Manufactured by AcoustiCotton, www.acousticotton.com.
   1. Northwest Distributor: Architextures/Magicare, 206.634.1166.

C. Thickness: 1 inch.

D. Density: 4.5 pounds.

E. NRC: 0.80

F. Material: 100% recycled post-industrial denim and cotton fibers.

G. Fire Hazard Classification: Class A fire rating.

H. Color: Black.

PART 3 – EXECUTION

3.01 EXAMINATION

A. General: Examine substrates and structural framing to which ceilings attach or abut, with installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

B. Layout: Measure each ceiling area and establish the layout of Wood Panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders,

and conform to the layout shown on reflected ceiling plans in accordance with wood ceiling manufacturer’s approved Shop Drawings.

3.03 INSTALLATION

A. General: Install ceiling grid and panel systems to comply with manufacturer's instructions and CISCA "Ceiling Systems Handbook."

B. Attachments: Suspend ceiling hangers from building's structural members per manufacturer’s instructions and in compliance with all local codes and regulations.

C. Installation of T-bar grid: Install in accordance with suspension manufacturer's instructions and in compliance with all local codes and regulations.

D. Suspension Runners: Install suspension system runners so they are square and securely interlocked with one another. Install number and use on-center spacing per wood ceiling manufacturer’s instructions, as indicated on approved Shop Drawings and in compliance with all local codes.

E. Installation of wood panels: Install wood ceiling panels in accordance with manufacturer’s installation instructions and in compliance with all local codes and regulations. Install with undamaged edges and fitted accurately to suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit, as required.

F. Field stain all exposed field-cut panel ends to match finish of panels.

3.04 CLEANING

A. Clean exposed wood surfaces in accordance with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace wood ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5426

SECTION 09 6466

WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood athletic floor assembly WAF-1.
   1. Work of the Section includes all tools and services to install a complete wood floor system from the concrete surface upward through the sanding and finishing, game lines, and installation of perimeter moldings and thresholds.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Floor flatness requirements.

B. Section 06 2000 - Finish Carpentry: Associated trim at wood athletic flooring used as seat.

C. Section 08 7100 - Door Hardware: Thresholds to be installed as Work of this Section.

D. Section 08 7101 - Hardware Schedule: Schedule of thresholds to be installed as Work of this Section.

E. Section 11 6123 - Retractable Stage: Platform to received hardwood flooring finish.

F. Section 11 6623 - Gymnasium Equipment: Athletic equipment installed through flooring assembly.

1.03 REFERENCE STANDARDS

A. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

D. MFMA (SPEC) - Guide Specifications for Maple Flooring Systems; Maple Flooring Manufacturers Association.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood athletic floor assemblies.
   1. Submit MFMA Recommendations for correct preparation, finishing and testing of concrete subfloor surfaces to receive wood flooring.
   2. Submit manufacturer's recommendations and requirements for flooring preparation, testing and slab conditions to meet warranty requirements.
   3. Confirm depth of recessed concrete slab to receive wood athletic floor system.

C. Shop Drawings: Show installation details including location and layout of each type of floor assembly and accessory. Include the following:
   1. Expansion provisions and trim details.
   2. Layout, colors, widths, and dimensions of game lines and markers.
   3. Locations of floor inserts for athletic equipment installed through flooring assembly.

D. Selection Samples: Manufacturer's color charts showing colors and glosses available for the following:
   1. Floor finish.
   2. Game-line and marker paint.
   3. Vented base.

E. Samples for Verification: For each type of athletic floor assembly and accessory required; approximately 12 inches and of same thickness and material indicated for the Work.

1. Include sample sets showing the full range of normal color and texture variations expected in wood flooring.
2. Include sample sets showing finishes and game-line paint and marker paint colors applied to wood flooring.

F. Qualification Data: For Installer.

G. Maintenance Data: For wood athletic floor assemblies and finish systems to include in maintenance manuals.
1. Include recommendations for types of tape that can be used by Owner for temporary line marking without damaging floor finish.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed wood athletic floor assembly installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in installations with a record of successful in-service performance and who is approved by the wood flooring manufacturer.
1. Installers shall be MFMA Mill Accredited Installation Company with MFMA Accredited Installers on-site for the duration of the wood floor installation.
2. Installer responsibilities include installation and field finishing of athletic floor assembly components and accessories, and application of game lines and markers.

B. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.
1. Provide flooring that carries MFMA mark on each bundle or piece.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver assembly materials in unopened cartons or bundles.

B. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry and similar wet work is complete and dry.

C. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

1.07 PROJECT CONDITIONS

A. Conditioning period begins not less than seven days before athletic floor assembly installation, is continuous through installation, and continues not less than seven days after athletic floor installation.
1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive athletic floor assemblies during the conditioning period.
2. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
a. Do not install athletic floor assemblies until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install athletic floor assemblies after other finishing operations, including painting, and all overhead work such as mechanical have been completed.

1.08 WARRANTY

A. Manufacturer's standard warranty that material is free from manufacturing defects.
1. Warranty Period: One year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: WAF-1 & WD-1:
   1. Action Floor Systems LLC; Action Thrust I; www.actionfloors.com.
   2. Connor Sports Flooring, Inc.; Product Neoshok; www.connorfloor.com.
   3. Robbins, Inc.; Product Bio-Cushion Classic; www.robbinsfloor.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 WOOD FLOORING

A. Strip Flooring: Northern hard maple (Acer saccharum), kiln dried, random length, tongue and groove, and end matched.
   1. Grade: MFMA-RL Second and Better.
   2. Thickness: 25/32 inch.
   3. Face Width: 2-1/4 inches.
   4. Provide continuous incremental expansion - factory milled.
   5. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.

2.03 SUBFLOOR SYSTEM

A. Subfloor: Minimum 15/32-inch thick, CD face, Exposure I, APA rated plywood sheathing or as recommended by flooring manufacturer.

B. Resilient Pads: Manufacturer's recommended rubber, EPDM or polyurethane pads installed at manufacturer's standard spacing for product designation indicated above. PVC pads are not acceptable.
   1. Material: Manufacturer's standard.
   2. Thickness: As recommended by manufacturer.

2.04 ACCESSORIES

A. Vapor Retarder: ASTM D4397, polyethylene sheet not less than 6 mils thick.

B. Resilient Wall Base, Type B-2: Molded, vented, rubber or vinyl cove base; 4 by 3; with premolded outside corners. Adhesive and mechanically fastened to wall.
   1. Color: As shown on drawings.

C. Thresholds: As specified in Section 08 71 00 - Door Hardware and scheduled in Section 08 71 01 - Hardware Schedule.

D. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.

E. Trowelable Leveling and Patching Compound: Portland-cement-based formulation approved by athletic floor manufacturer.

F. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer and MFMA approved.
   1. Finish Type A: Moisture Cured Urethane: "Moisture Cure Urethane" by Harco Chemical Coatings, Inc.; "Polopaz Moisture Cure Urethane" by National Coatings, or approved. Apply two coats.
   2. Finish Type B: Waterborne Urethane: "Bona Traffic" by BonaKemi USA, "Jon-Wood" by Johnson Wax, "Curator with Crosslinks" by Preferred Products, "Tradition 6200" by Harco Chemical Coatings, Inc, or approved. Apply two coats.
   3. Finish Type C: Oil Modified Polyurethane Oil: "Woodline" by BonaKemi USA, "Gym Coat 9000" by Harco Chemical Coatings, Inc, or approved. Apply two coats
   4. Game-Line and Marker Paint: Finish Type A & C: "U35 two part epoxy" by Forrest Paints; Finish Type B: Oil based enamel by Benjamin Moore.
   5. VOC Content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
b. Game-Line and Marker Paint: VOC content of not more than 150 g/L.

6. Available Floor Finish Products:
   a. As noted in Finish Types above.
   b. Substitutions: Section 01 60 00 - Product Requirements.
7. Finish at concrete Plinth Seating: Stain to match "Sierra 20" by Oregon Door using method recommended by flooring manufacturer. Follow with Finish Type A above.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of athletic floor assemblies.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Concrete Slabs: Verify that concrete slabs comply with requirements specified in Section 03 3000 - Cast-in-Place Concrete.
   1. Moisture Testing: Perform tests in accordance with ASTM F1869, unless otherwise recommended by manufacturer. Proceed with installation only after substrates pass testing.
   2. Relative Humidity Testing (In-Situ Probe Test): Perform tests in accordance with ASTM F2170. Use a prepackaged relative humidity testing kit (ASTM F2170) and follow the manufacturer's instructions.
      a. Relative humidity level shall be 80 percent or lower before installation, unless manufacturer has more stringent requirements.

3.02 PREPARATION

A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
   1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. General: Comply with athletic floor assembly manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.

B. Pattern: Lay flooring parallel with long dimension of space to be floored, unless otherwise indicated.

C. Expansion Spaces: Provide 1-1/2- to 2-inch expansion void as required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
   1. Cover expansion spaces with vented base.

D. Vapor Retarder: Install vapor retarder over entire area to be covered by wood athletic flooring, with joints lapped a minimum of 6 inches and sealed.

E. Assembly:
   1. Attach resilient pads to underside of the first layer of plywood and 12 inches on center, unless otherwise recommended by flooring manufacturer.
   2. Place the first layer of plywood diagonal or perpendicular to the intended direction of the finish flooring, allowing 1/4 inch spacing at all edges.
   3. Lay the second layer of plywood without pads at the opposite 45 degree angle or at right angles to the first layer. Do not allow joints in the second layer to coincide with a joint in the first layer. Fasten layers together using manufacturer's recommended fasteners and spacing. Allow 1/4 inch between panel edges.

4. Provide 1-1/2 to 2 inch expansion space, as required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
5. Install strip flooring onto second layer of plywood parallel to the long dimension of the room. Provide adequate expansion at regular intervals across the floor during installation as dictated by the average humidity condition of the area according to the recommendations of the flooring manufacturer and installer.

F. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

G. Vented Cove Base: Install manufacturer's recommended vented cove base, using premolded outside corners and mitered inside corners.

H. Thresholds: Install thresholds furnished as Work of Section 08 71 00 - Door Hardware at all transitions of wood athletic flooring to other flooring to span expansion voids and to provide an even, accessible transition.
1. Attach thresholds to adjacent floor surfaces to allow for movement of wood flooring system. Do not attach to wood athletic flooring.

3.04 SANDING AND FINISHING

A. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."

B. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.

C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without drum stop marks, ridges, cups, gouges, streaks or shines. Remove sanding dust by tack or vacuum.

D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide not less than six coats total and not less than two finish coats. Minimum 2 mils per coat. Buff and vacuum or tack between each coat after it dries.
1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and side bonding effect.
2. Game Lines and Markers: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions. Lightly buff paint after drying to assure proper finish adhesion.
   a. Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
   b. Where game lines cross, break minor game line at intersection; do not overlap lines.
   c. Apply game lines and markers in widths and colors according to requirements of Oregon School Activities Association (OSAA) and National Federation of State High School Association.
   d. Apply finish coats after game-line and marker paint is fully cured.

3.05 PROTECTION

A. Protect athletic floors during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.
1. Do not cover athletic floors after finishing until finish reaches full cure, and not before seven days after applying last finish coat.
2. Do not move heavy and sharp objects directly over athletic floors. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over athletic floors.

END OF SECTION 09 6466

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient base.

B. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

C. Section 09 2116 - Gypsum Board Assemblies: Gypsum board wall substrate.

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

E. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions. Provide data on sealer, if recommended by flooring manufacturer.

C. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.

D. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Wall Base: 1 carton of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing resilient flooring with minimum three years documented experience.

B. Installer Qualifications: Compancy specializing in installing specified flooring products with minimum 5 years experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect roll materials from damage by storing on end.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; top set Style B, Cove.
   1. Manufacturers:
      a. Burke Flooring: www.burkeflooring.com/#sle.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com.
      c. Roppe Corp: www.roppe.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with NFPA 253 (Class 1).
   3. Height: 4 inch.
   4. Thickness: 0.125 inch.
   5. Finish: Satin.
   6. Length: Roll.
   7. Color: As shown on drawings.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. VOC Content: As specified in Section 01 6116.

C. Sealer: Type recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Clean substrate.

B. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

E. Owner Testing: Owners' Project Manage will randomly remove at section of rubber base at 5 locations to verify proper installation. If base has not been installed correctly, Reinstall base at test locations.

3.05 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.06 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 6500

SECTION 09 6813

TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Walk off Mat tile

B. Concrete Slab Moisture Barrier

C. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

C. Section 09 6816 - Sheet Carpeting: Broadloom carpet.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of joints, direction of carpet pile, and location of edge moldings.

C. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Submit two, 12 inch long samples of edge strip and base cap.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: 2 unopened boxes of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Carpet Tile Type CPT-1 and CPT - 3: Tufted, patterned loop, manufactured in one color dye lot..
   1. Product: 2nd Power manufactured by Tandus Centiva by Tarkett: www.commerical.tarkett.com.
   2. Tile Size: 24 x24 inch, nominal.
   3. Finished Pile Thickness:.187 inch.
   4. Color: As indicated on drawings.
   5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   6. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   7. Gage: 5/64 inch.
   8. Dye Method: 100% solution dyed.
   9. Installation: Vertical Ashlar
   10. Primary Backing: ER3 Modular.

B. Walk Off Mat, WOM - 1: 100 percent Asota solution-dyed UV stabilized polypropylene fibers backed with ExoDi composite rubber backing.
   1. Products:
      a. Connexus; Product Super Nop 52 Tile: www.connexusflooring.com.
      b. van Gelder; Inc; Product Champion Super Nop Tile: www.vangelder-inc.com.
   2. VOC Content: Provide CRI Green Label Plus certified product; in lieu of labeling, independent test report showing compliance is acceptable.
   3. Tile Size: 19-11/16 inches by 19-11/16 inches.
   4. Color: As indicated on drawings.
   5. Pile Height: 1/2 inch nominal
   6. Backing Material: High Density Rubber.
   7. Total Weight: 78 TO 93 oz/sq yd. As standard with the manufacturer.

C. Concrete Slab Moisture Barrier:
   1. High strength, latex-based compound formulated to isolate cut-back and existing adhesives that could affect the bond of the new floor adhesives.
   2. The slab sealer material must be compatible with previously applied curing agents, and adhesives and must meet the CRI low-VOC emission criteria, C.R.I. ID# AA-580309, and shall not contain any known hazardous materials. The material must be non-toxic, ultra-low odor, waterproof when dry.
   3. Flammability Certification: Class A: Passes tunnel test ASTM number E84-70 (identical test method to ANS Number 2-5), NFPA number 755, UL number 723, and UBC 42-1.
   4. Warranty: Provide manufacturers lifetime moisture vapor emissions and moisture penetration warranty. Follow manufacturer's installation instructions exactly to guarantee that warranty will be issued.
   5. Products:
      a. J & J Commercialon: 877 Premium Barrier Coat

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Transition Strips: Glue-down vinyl or rubber. Roppe #174 Glue-Down Reducer, 1/4 inch, or approved equal , color as selected by Architect.

C. Adhesives: Acceptable to carpet tile manufacturer, compatible with materials being adhered; maximum VOC of 50 g/L; CRI Green Label certified.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Vacuum clean substrate.

D. Wet mop immediately prior to new carpet tile installation, and remove all deleterious substances which would interfere with the installation, would be harmful to the work, or would inhibit the free-lay method of installation of carpet tiles.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in ashlar pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Roll the entire carpet installation with a 75 pound or greater roller to assure proper adhesion to the substrate if required in manufacturer’s installation instructions.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 WALK OFF MAT INSTALLATION

A. Install in strict accordance with manufacturer's recommendations, using manufacturer'srecommended adhesive suitable for project conditions.

B. Follow manufacturer's recommended seaming techniques.

C. Roll with appropriate roller for complete contact of adhesive to entry mat backing, rolling at least twice, once in each direction.

D. Keep all traffic off entry mat for 24 hours after installation. Wait 72 hours prior to initial cleaning.

E. Lay entry mat in pattern as directed by manufacturer.

3.05 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION 09 6813

SECTION 09 6816

SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Broadloom Carpet, direct-glued.

B. Accessories

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.

C. Section 09 6813 - Tile Carpeting.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

G. CRI (GL) - Green Label Testing Program - Certified Products; Current Edition.

H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings.

D. Samples: Submit two samples 12 inch by 12 inch in size illustrating color and pattern for each carpet and cushion material specified.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional requirements.
   2. Extra Carpet: 120 sq ft of each type, color, and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 CARPET

A. Carpet, Type CPT - 2: tufted patterned loop
   1. Product: 2nd Power manufactured by Tandus Centiva by Tarkett: www.commerical.tarkett.com.
   2. Roll Width: 6 ft.
   3. Finished Pile Thickness: .187 inch
   4. Color: As indicated on drawings.
   5. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   6. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   7. Gage:5/64 inch.
   8. Dye Method: 100% solution dyed
   9. Primary Backing: Synthetic Non-Woven

2.02 ACCESSORIES

A. Subfloor Filler: Type recommended by carpet manufacturer.

B. Transition Strips: Glue-down vinyl or rubber. Roppe #174 Glue-Down Reducer, 1/4 inch, or approved equal ; style appropriate for thicknesses of materials used, color as selected by Architect.

C. Seam Adhesive: Recommended by carpet manufacturer.

D. Carpet Adhesive: Recommended by carpet manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing carpet and carpet cushion.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

F. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION 09 6816

SECTION 09 8405
ACOUSTICAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustic Wall Panels

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 5100 - Acoustical Ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than 5 years of experience in manufacturing acoustical products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation.

B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.

C. Protect panel edges from damage.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for additional mock-up requirements.

B. Construct mock-up of acoustical panels at location indicated by Architect.
   1. Minimum mock-up dimensions: 96 x 96 inches.
   2. Approved mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustical Panels for use on Camas Flowers :
   1. Basis of Design: Fsorb: https://www.f-sorb.com/

B. Substitutions: See Section 01 6000 - Product Requirements.

C. Provide all acoustical panels by single manufacturer.

2.02 ACOUSTICAL WALL PANELS

A. Acoustical Panels for Camas Flowers: Type AWP - 1, AWP - 2, AWP - 3, AWP - 4, AWP - 5
   1. Basis of Design: 1/2 and 1 inch sheets by Fsorb
   2. Nominal Size: As indicated on drawings

3. Nominal Thickness: As indicated on drawings
4. Color: As indicated on interior finish legend on drawings
5. Acoustical Performance: Sound absorption NRC of 0.50
6. Cut Shapes: As indicated on drawings. CAD files can be provided by Architect.
7. Location: As indicated on drawings

B. Custom graphic printed onacoustic panel: Type AWP - 6
1. Basis of Design: Printed Panel by acoufelt; https://acoufelt.com/
   a. Material: 100% polyester FilaSorb
   b. Thickness: approximately 1 inch
   c. Panel size: As indicated on Drawings.
   d. Mounting: interlocking z-clips
   e. Location: Cafeteria
2. Acceptable Alternative: Kinetics Noise Control; kineticsnoise.com

C. Acoustic fabric wrapped panel: Type AFWP-1, AFWP-2, AFWP-3
1. Basis of Design: Carnegie Xorel Artform Wall Panels
2. Shapes: Diamond - XL, Diamond 2XL, Waveline - L
3. Substrate: Quiet-Core
4. Fabric: As indicated on interior finish legend on drawings
5. Mounting: Quick Grab Method
6. Location: Cafeteria

2.03 ACCESSORIES

A. Panel Adhesive:
1. Refer to section 01 60 00 (01600) - Product Requirements for VOC limits for adhesives, sealants, paints and coatings.
2. Acceptable to panel manufacturer for application indicated

B. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
1. Z-clip hanger and magnet system with magnets recessed into panel frame and designed to engage steel mounting plates secured to substrate with screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical panels. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical panels in locations indicated on drawings, following installation recommendations of panel manufacturer. Align panels accurately, with edges plumb and top edges level.

B. Install panels to construction tolerances of plus or minus 1/8 in for the following:
1. Plumb and level.
2. Flatness.
3. Width of joints.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until completion of the work.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION 09 8405

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Materials for backpriming woodwork.

D. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment. Leave plywood rating data stamps exposed and unpainted.
   2. Elevator pit ladders.
   3. Exposed surfaces of steel lintels and ledge angles.
   4. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

E. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne, and lead items, unless otherwise indicated.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically so indicated.
   9. Ceramic and other tiles.
   10. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Glass.
   12. Acoustical materials, unless specifically so indicated.
   13. Concealed pipes, ducts, and conduits, including all work on Mechanical Platform level.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 1200 - Structural Steel Framing: Shop primed items.

C. Section 05 5000 - Metal Fabrications: Shop-primed items.

D. Section 09 9600 - High-Performance Coatings: Coating systems for ferrous and galvanized metals within reach of occupants and as shown on Drawings.

1.03 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, and repair of painted and coated surfaces.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Coatings: 1 gallon of color P-1; store where directed. No other colors required.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 10 feet long by 10 feet wide, illustrating paint coating cut-in, color, texture, and finish.

C. Provide door and frame assembly illustrating paint coating cut-in, color, texture, and finish.

D. Locate where directed.

E. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction over project.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide all specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
   2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.

C. Paints:
   1. Glidden Professional, a product of PPG Architectural Coatings: www.gliddenprofessional.com.
   2. Benjamin Moore & Co: www.benjaminmoore.com/#sle.
   3. Parker Paint Mfg Co Inc., a Comex Group company: www.parkerpaint.com.
   4. PPG Paints: www.ppgpaints.com/#sle.
   5. Pratt & Lambert Paints: www.prattandlambert.com/#sle.
   6. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

D. Primer Sealers: Same manufacturer as top coats.

E. Block Fillers: Same manufacturer as top coats.

F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
   2. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   5. Supply each coating material in quantity required to complete entire project's work from a single production run.
   6. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

D. Chemical Content: The following compounds are prohibited:
   1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium,

isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Flammability: Comply with applicable code for surface burning characteristics.

F. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

G. Colors: As indicated in Color Schedule
   1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
   2. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

2.03 REFERENCED GLOSS LEVELS

A. Some of the following Gloss Level references may be used in the Paint Systems outlined below and are defined here for reference. Gloss units are as measured at 60 degrees from perpendicular, per ASTM D523.
   1. Gloss Level 1 a traditional matte finish - flat: maximum 5 units.
   2. Gloss Level 2 a high side sheen flat - a 'velvet-like' finish: maximum 10 units.
   3. Gloss Level 3 a traditional 'eggshell-like' finish: 10-25 units.
   4. Gloss Level 4 a 'satin: 20-35 units.
   5. Gloss Level 5 a traditional semi-gloss: 35-70 units.
   6. Gloss Level 6 a traditional gloss: 70-85 units.
   7. Gloss Level 7 a high gloss: more than 85 units.

2.04 PAINT SYSTEMS - EXTERIOR

A. Concrete, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer, alkali-resistant, MPI #3.
   2. Satin: Two coats of latex enamel, MPI #161.

B. Ferrous Metals: Specified in Section 09 9600 High-Performance Coatings.

C. Galvanized-Metal Substrates:
   1. Two-Component, Pigmented Aliphatic Acrylic Polyurethane: One finish coat, over intermediate coat and metal primer.
      a. Prime: Manufacturer's recommended metal primer.
         1) AkzoNobel Devoe Coatings: 224HS Devran Epoxy Coating.
         2) Sherwin Williams: Dura Plate 235 Multi-Purpose Epoxy Primer (High Solids).
      b. Intermediate Coat: Polyamide Epoxy; MPI #108.
         1) AkzoNobel Devoe Coatings: Bar-Rust 235 Epoxy.
         2) Sherwin Williams: Macropoxy 646 Fast Cure Epoxy B58.
         3) Applied 3.0 - 5.0 mils dry film thickness, or greater if recommended by manufacturer for even color.
      c. Finish Coat: Aliphatic Urethane - Finish Coat; MPI #72.
         1) AkzoNobel Devoe Coatings: Devthane 379.
         2) Sherwin Williams: Hi-Solids Polyurethane 250.
         3) Applied 2.0 - 3.0 mils dry film thickness, 3.2 - 4.8 wet.
         4) Gloss: MPI gloss level 6-7.
      d. Additional Topcoats: Manufacturer's recommended clear topcoat, it any, as required to ensure colorfastness of final coating system.
      e. Locations: At flower pole petals and bases, and as indicated on drawings.

D. Pavement Marking Paint:
   1. One coat: MPI #97, Latex Zone/Traffic Marking Paint.
   2. White: One coat, .

2.05 PAINT SYSTEMS - INTERIOR

A. Concrete Masonry, Opaque, Latex, 3 Coat:

1. One coat of block filler, MPI #4.
2. One coat of primer sealer, MPI #6
3. Satin: Two coats of latex enamel, MPI #161.

B. Wood, Transparent, Low-VOC Polyurethane Varnish:
1. One coat sealer recommended by varnish manufacturer.
2. Satin: Two coats of varnish, MPI #128.

C. Wood, Transparent, Stain, Low-VOC Polyurethane Varnish:
1. One filler coat as recommended by Stain manufacturer for wood species being coated.
2. One coat stain, MPI #90.
3. Satin: Two coats of varnish, MPI#128.

D. Ferrous Metals in reach of building occupants: Specified in Section 09 9600 High-Performance Coatings.

E. Ferrous Metals, shop-primed, overhead, Low-VOC dry-fall Latex:
1. Spot-prime with rust-inhibitiveprimer, MPI #107.
2. One coat of latex dry-fall, MPI #155.

F. Galvanized Metals, out of reach of building occupants: Low-VOC Latex:
1. One coat galvanize primer, MPI 134.
2. Semi-gloss: Two coats of latex enamel, MPI #147.

G. Gypsum Board/Plaster, Wet Areas (restrooms, showers, kitchens, janitor's rooms, and where noted):
1. One coat of PVA epoxy primer sealer, MPI #50.
2. Semi-gloss: Two coats of epoxy enamel, MPI #215.
3. Apply primer prior to wall texture provided by 09 2116.

H. Gypsum Board/Plaster, all other areas:
1. One coat of PVA primer sealer, MPI #50.
2. Eggshell (Satin): One coat of latex enamel, MPI #146.
3. Apply primer prior to wall texture provided by 09 2116.

2.06 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

G. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION 09 9000

SECTION 09 9600

HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings ("HP-#" on Drawings) for the following conditions:
   1. Exterior galvanized and non-galvanized ferrous metals
   2. Interior galvanized and non-galvanized ferrous metals in reach of occupants.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 05 1200 - Structural Steel Framing: Shop priming of metal substrates with primers specified in this Section.

C. Section 05 5000 - Metal Fabrication: Shop priming of metal substrates with primers specified in this Section.

D. Section 05 5100 - Metal Stairs: Shop priming of metal substrates with primers specified in this section.

E. Section 08 11 13 - Hollow Metal Doors and Frames: Shop priming of metal substrates with primers compatible with primers specified in this Section.

F. Section 09 9000 - Painting and Coating.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; 2016.

E. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; 2015.

F. SSPC-PA 1 - Shop, Field, and Maintenance Painting of Steel; 2016.

G. SSPC-PA 2 - Procedure For Determining Conformance To Dry Coating Thickness Requirements; 2015, with Editorial Revision (2018).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.

C. Samples: Submit two samples 8 by 8 inch in size illustrating colors available for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Coating Materials: 1 gallon of each type and color.
2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.05 PRE-INSTALLATION CONFERENCE

A. Preinstallation Conference: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers. Agenda items will include field conditions, substrate conditions, coordination of shop applied primers with finish coatings, application methods, and field quality control testing and inspection.
   1. Bring copies of reviewed color draw-downs for all required colors

1.06 QUALITY ASSURANCE

A. Master Painters Institute (MPI) Standards:
   1. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and coating systems indicated.

B. Surface Preparation: Obtain written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator(s) to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.

C. Comply with requirements of SSPC-PA 2 for measurement of coating thickness.

1.07 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

D. Restrict traffic from area where coating is being applied or is curing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Only materials (primers, coatings, etc.) listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project.

B. Provide high performance coating products from the same manufacturer to the greatest extent possible.

C. High-Performance Coatings Manufacturers:
   1. Carboline Company (Carboline)
   2. Corotech
   3. ICI Devoe
   4. Kelly-Moore Paints
   5. Miller Paint Co.
   6. Benjamin Moore & Co.
   7. PPG Industries, Inc.
   8. Rodda Paint / Cloverdale Paint Co.
   9. Sherwin-Williams Co.
   10. Tnemec Company, Inc.
   11. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

B. Material Compatibility: Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

C. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards Architectural Coatings.
         1) Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water add at project site; or other method acceptable to authorities having jurisdiction.

D. Chemical Content: The following compounds are prohibited at interior applications:
   1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di(2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromiuisophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

2.03 EXTERIOR HIGH-PERFORMANCE COATINGS

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on appropriately shop-primed items. ("HP-#" on Drawings)
   1. Zinc-rich primer, MPI #19, applied to 2.5 to 3.5 dry film thickness.
   2. Polyamide Epoxy, MPI #108, applied 3.0 to 5.0 mils dry film thickness.
   3. Aliphatic Acrylic polyurethane Coating: MPI #83, applied to 2.0 to 3.0 mils dry film thickness.

B. Galvanized Ferrous Metals:
   1. Primer, Epoxy, Anti-Corrosive, for Metal, MPI #101; one coat.
   2. Light Industrial Coating, Exterior, Water Based, MPI #161; one coat.
   3. Aliphatic Acrylic Polyurethane Coating, MPI #83, two coats.

2.04 INTERIOR HIGH-PERFORMANCE COATINGS

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on appropriately shop-primed items. ("HP-#" on Drawings)
   1. Low-VOC High-Build Epoxy:
      a. Zinc-rich primer, MPI #19; one coat.
      b. Polyamide epoxy, MPI #108; coats as required for coverage.
      c. Aliphatic Acrylic polyurethane Coating, MPI #83, coats as required for coverage.

B. Galvanized Ferrous Metals:
   1. Primer, Epoxy, Anti-Corrosive, for Metal, MPI #101; one coat.
   2. Light Industrial Coating, Exterior, Water Based, MPI #161; one coat.
   3. Aliphatic Acrylic Polyurethane Coating, MPI #83, two coats.

C. Shellac: Pure, white type.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

E. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

F. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.
   2. At interior steel abrade the top layer of primer, unless otherwise required by coating manufacturer.
   3. At exterior steel, provide surface preparation equivalent to SSPC-SP 6 "Commercial Blast Cleaning."

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

H. Remove finish hardware, fixture covers, and accessories and store.

I. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

J. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

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. When the color of a door frame changes from side to side, the change shall be made at the edge of the stop, where the transition is not visible when the door is in a closed position.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for general requirements for field inspection.

B. Painted surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to Architect.
   1. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, or foreign materials in paint coatings.
   2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners, reentrant angles or similar conditions.
   3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
   4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
   5. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).

C. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces:
   1. Visible defects are evident on vertical or horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
   2. Visible defects are evident on ceilings, soffits and other overhead surfaces when viewed at normal viewing angles.
   3. When the final coat on any surface exhibits a lack of uniformity of color, sheen texture and hiding across full surface area.
   4. Dry mil thicknesses do not meet manufacturer's recommended thickness or specified thickness.
   5. Lack of adhesion. Test surfaces indicating lack of adhesion in accordance with ASTM D3359 or as recommended by coating manufacturer.

D. Owner will provide field inspection and testing.
   1. Painted surfaces will be tested for dry mil thickness for each coat.
   2. Shop primers and painted surfaces will be tested for adhesion.
   3. Surfaces will be tested at frequency discussed in the preinstallation conference and as deemed appropriate by Owner

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.07 PROTECTION

A. Protect finished work from damage.

END OF SECTION 09 9600

SECTION 10 1100

VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards

B. Tackable Wall Panels

C. Map Rail

D. Flag Holder

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

B. Section 09 2216 - Non-Structural Metal Framing: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2016.

B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

D. ASTM C540 – Gloss Test for Porcelain Enamel Steel (Porcelain Enamel Institute PEI-501)

1.04 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit two samples 2 by 2 inch in size illustrating materials and finish, color and texture of chalkboard, markerboard, tackboard, tackboard surfacing, and trim.

E. Manufacturer's printed installation instructions.

F. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Submit manufacturer’s “Life of Building” warranty, stating that under normal usage and maintenance, and when installed in accordance with manufacturer’s instructions and recommendations, Porcelain-on-Steel Markerboards and Chalkboards are guaranteed for the life of the building.

C. Warranty shall cover replacement of defective Porcelain-on-Steel Markerboards and Chalkboards due to discoloration, excessive fading of color, crazing, cracking or flaking. Warranty does not cover the cost of removal or reinstallation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Markerboards:

1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
2. Polyvision Corporation (Nelson Adams): www.polyvision.com.
3. Platinum Visual Systems: www,pvusa.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Tackable Wall Panels:
   1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
   2. Polyvision Corporation (Nelson Adams): www.polyvision.com.
   3. Platinum Visual Systems: www.pvusa.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MARKERBOARDS

A. Markerboards: Porcelain enamel on steel, laminated to core; magnetic type, prefabricated units.
   1. Basis of Design: Writanium Markerboards by Platinum; www.pvusa.com.
   2. Color: Similar to Bright White by Platinum.
   3. Steel Face Sheet Thickness: 28 gauge, 0.0149 inch.
   4. Core: Particleboard, 1/2 inch thick
   5. Backing: Aluminum foil, laminated to core.
   6. Size: As indicated on drawings.
   7. Frame: Extruded aluminum, full perimeter.
   8. Frame Finish: Anodized, Clear Satin.
   9. Accessories: Provide marker tray at each marekerboard and 1" map rail where indicated on drawings.

2.03 TACK SURFACE WALL PANELS

A. Tack Surface Wall Panels; Type TS - 1 and TS - 2.
   1. Basis of design: Tack Walls by Claridge
   2. Type: Designer Fabric wrapped panel on duracore backing with metal trim edges
   3. Substrate: Duracore
   4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
   5. Fire Rating: Class A, per NFPA.
   6. Thickness: 7/16 inch.
   7. Edge Treatment: Square.
   8. Size: As indicated on drawings.
   9. Fabric: Pre-Approved COM by Maharam;www.maharam.com
      a. Messenger by Maharam
      b. Color: As indicated on finish legend.
   10. Fabrication:
      a. Field verify locations of any outlets, switches, or controls that need to be cut to fit prior to fabrication.
      b. Wrap fabric around edges of panel to backside and laminate to substrate per manufacturer's recommendations.
      c. Fabricate panels to sizes and shapes indicated.
      d. Attach fabric facing to cores to produce installed panels with visible surfaces fully covered and free from waves in weave, sags, blisters, seams, and adhesive or foreign matter.
      e. No exposed fasteners shall be visible.
   11. Trim
      a. Material and product: Extruded Aluminum Trim, Fabric Covered Tack Wall Trim
      b. Finish: Satin Anodized.
      c. Extent of Work: At all Tack Surface Wall Panels

B. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall, full width of frame.
   1. Length: As shown on drawings.
   2. Extent: At Hallways where indicated on drawings.
   3. Manufacturers:

a. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
b. Nelson Adams NACO: www.nelsonadamsnaco.com/
c. Quartet Bulletin Bar: www.quartet.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces, formaldehyde-free.

C. Foil Backing: Aluminum foil sheet, 0.005 inch thick.

D. Adhesives: Low VOC or water-based, approved by panel manufacturer, and complying with requirements of Section 01 6116.

2.05 ACCESSORIES

A. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

B. Flag Holders: Cast aluminum bored to receive 1 inch diameter flag staff, screw mounted to wall.

C. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.

D. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive-applied boards.

3.02 INSTALLATION

A. Install markerboards in accordance with manufacturer's instructions for adhesive installation.

B. Secure units level and plumb.

C. Butt Joints: Install with tight hairline joints.

D. Install tackable wall panels in accordance with manufacturer's recommendations on specified substrates with concealed attachments.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION 10 1100

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast Metal Letter Signs surface mounted.

B. Exterior Electronic Reader board

C. Room and Door Signs.

D. Interior Directional and Informational Signs.

E. Traffic Signs.

F. Monument Signs.

G. Sign Permit.

H. Dimensional Letters applied to building surfaces.

1.02 RELATED REQUIREMENTS

A. Section - 03 1000 - Concrete Forming and Accessories, reinforcing for concrete base.

B. Section - 03 2000 - Concrete Reinforcing, formwork for concrete base.

C. Section - 03 3000 - Cast-in-Place Concrete, concrete base.

D. Section - 07 6200 - Sheet Metal Flashing and Trim, Flashing and trim at Monument Sign

E. Section - 07 9005 - Joint Sealers, sealants at Monument Sign.

F. Section 22 0553 - Identification for Plumbing Piping and Equipment.

G. Section 26 0553 - Identification for Electrical Systems.

H. Section 26 5100 - Interior Lighting: Exit signs required by code.

I. Divisions 26 and 27 - Electrical and Data connections and interface with reader board.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible Design).

B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

C. UL 1994 - Luminous Egress Path Marking Systems; Current Edition, Including All Revisions.

D. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines; 2002.

E. OSSC - Oregon Structural Specialty Code.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design monument sign, using experienced designer of similar custom monument signs using performance requirements and design criteria indicated.

B. Provide design adequate to meet Eugene Sign Code, Oregon Structural Specialty Code requirements for wind load, and Electrical Code for wiring. Wind load design criteria as stated on Structural Drawings.

1.05 WARRANTY

A. Warrant Reader Board sign parts and factory labor for 5 years. Fully replace damaged or nonfunctional components in place within warranty period.

1.06 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Shop Drawing: Provide half-size layout drawing, to scale, indicating spacing between letters and words, space around edges, and relationship to mounting substrate.

D. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Architect prior to fabrication.
   4. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
   5. Verification Samples: Submit samples showing colors specified.
   6. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

E. Delegated-Design Submittal: Provide design drawings showing exterior appearance, interior construction, supports, mountings, software, reader board, and wiring.
   1. Submit submittals in accordance with Section 01 3300. Submit as required to City of Eugene. Obtain Sign Permit. Provide copy of permit to Owner.
   2. Submit samples of Readerboard Video AVI clips.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Store tape adhesive at normal room temperature.

1.08 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

1.09 QUALITY ASSURANCE

A. Manufacturer qualifications: Company specializing in design and manufacturer the products specified int his section with minimum five years of documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS - GENERAL

A. Accessibility Compliance: All signs are required to comply with ADA Standards for Accessible Design and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

2.02 ROOM SIGNS

A. Sign Style: Flat panel, frameless, with applied letters
   1. Substrate: ¼ inch thick acrylic panel, back painted, See signage schedule for color.
   2. Sign Types B and D to include accommodations for paper insert, see drawings.
   3. Fabricate units to configurations and sizes as indicated on drawings and schedule. Edges and surfaces to be straight, smooth, and true.

B. Lettering:
   1. Tactile Letters: Precision cut acrylic letters applied with very high strength adhesive.
   2. Vinyl Letters: First surface applied vinyl letters.
   3. Character Height: See drawings.

4. Color: See drawings

C. Graphic Images: Provide graphic images painted onto back side of acrylic panel. Digital files of graphic images provided by Architect.

D. Braille: Press fit 1/16 inch diameter clear acrylic beads into pre-drilled holes to create Class II Braille. Contractor to provide text translation from English to Class II Braille.

E. Tactile Symbols: Including but not limited to pictograms. Precision cut acrylic applied with very high strength adhesive. See drawings.

F. Mounting: VHB tape. Where mounted to glass, provide solid back painted acrylic panel to be mounted to the back side of glass. See drawings for locations.

2.03 DIMENSIONAL LETTERS

A. Metal Letters at Monument Sign:
   1. Manufacturers:
      a. ARK Ramos
      b. Architectural Metal Crafters
      c. OMC Industries
      d. Metal Arts, www.metalarts.com
      e. Substitutions.
      f. Product: Similar to ARK Ramos Precision Cut Letters.
   2. Materials and Type.
      a. Material: Mechanically cut 11 gage sheet steel.
      b. Mounting: Pin type per Manufacturer's recommendation. Provide 1 inch space between face of mounting surface and back of letter, unless noted otherwise.
      c. Letter Style: Font face and size as indicated on drawings.
      d. Letter Height and Text: As noted on drawings.
      e. Finish: Powder coated. Color as selected by Architect from manufacturer's full range of options.

B. Vinyl Letters: Self-adhering, peel-off vinyl letters, reverse adhesive
   1. At interior locations shown on Drawings:
      a. Manufacturer: Contractor's choice.
      b. Letter Style: Futura No. 501, all capitals, unless noted otherwise.
      c. Letter Height: 7 inches tall, unless noted otherwise.
      d. Letter Text: As noted on drawings.

2.04 TOILET ENTRY SIGNAGE

A. General Description: Sheet metal wall wrap with CNC cut out letters over painted finish.

B. Material: 304 stainless steel sheet, 18 gage, #4 finish. Brake form to shape indicated on Drawings.

C. Cut Letters: Laser or similar mechanical cutting process that leaves a smooth, crisp line.
   1. Hand burnish to ensure no sharp edges remain.
   2. Painted backing plate: Powder-coated 20 gage steel sheet behind cut letters.

D. Dimensions: See Drawings for general layout. Coordinate field conditions prior to fabrication.

E. Installation: Adhere to smooth, flat, straight wall, no exposed fasteners.

2.05 MONUMENT SIGN

A. Concrete base; As indicated on drawings. Work to comply with Sections 03 1000, 03 2000, and 03 3000 covering concrete forming, reinforcing and poured in place concrete.

B. Wall cap: Stainless Steel wall cap and 1 inch aluminum bar.

C. Composite Wood Shim at Wall Cap: 1/2 inch by 9 1/2 inch composite wood shim. Selectforce Continuous Extrusion by Bedford Technology; www.bedfordtech.com.

D. Fasteners: Tamperproof stainless steel expansion anchors. Flat head type with T45 driver. Size: 3/8 inch x 5 inch. Manufacturer: Loss Prevention Fasteners, at losspreventionfasteners.com

E. Display Protection: Single, 1/4-inch clear polycarbonate sheet over each display face. Integrated, continuous supports.

F. Reader Board:
   1. Manufacturer and Brand: Daktronics Galaxy Outdoor Message Center GS6 Series, 19.8 MM RGB.
   2. Substitutions: See Section 01 6000 - Product Requirements.
   3. Features:
      a. Exterior rated LED Display, 2 sided.
      b. 19.8 mm, 32 x 100 matrix
      c. RGB LEDs producing trillions of colors
      d. 90 degree full brightness viewing
      e. Viewing Range: 45 ft or greater.
      f. Character Height: 5.5 inches min.
      g. Cabinet: Extruded aluminum, solid welded corners
      h. Color: As selected by Architect
      i. On Demand Diagnostics Included
      j. Module Dimensions: As recommended by manufacturer.
   4. Display:
      a. Screen size as shown on drawings
      b. Dislay Configuration: Two-View (two, one-sided displays installed back-to-back showing same content)
      c. Capable of full color graphic and animation displays
      d. LED life Minimum: 100,000 hours
   5. Additional Requirements:
      a. Weather resistant: Tested for salt spray, immersion under water, salt spray resistant, temperature rated for operation from minus 40 degrees to 185 degrees farenheit.
      b. Power: 120 Volt, single phase
      c. Video Capability: Imported pre-recorded AVI clips
      d. Communications Options: fiber optic, LAN & WAN broadband.
      e. Ventilation: Provide ventilation spaces and pathways as recommended by manufacturer.
   6. Software
      a. Web browser based software
      b. On screen preview available.
      c. Ability to create text and images displayed still or in motion.
      d. Provide with library of graphics for manipulation by user.
      e. Training manual/videos
      f. Similar to Venus Control Suite for message displays by Daktronics.

G. Fabrication
   1. Fabricate sign in compliance with the recommendations of product manufacturers
   2. Minimize exposed fasteners.
   3. Construction to be vandal resistant.

H. Metal letters: As specified above.

2.06 TRAFFIC CONTROL & ACCESSIBLE PARKING SIGNS

A. Manufacturer: Contractor's choice.

B. Material: 18 gage bonderized steel or.080 inch aluminum.

C. Finish: Baked Enamel - both sides finished

D. Location: See Drawings

E. Manufacturing Standards: Comply with Oregon State Highway Department Standard Regulations.

F. Supports: 2 inch Inside diameter Galvanized Steel Post, unless otherwise shown on drawings.
   1. Provide poles of sufficient length to mount bottom of sign 7 feet above finished grade at base of pole.
   2. Mounting: Cast support post into concrete footing. Through bolt sign to post with tamperproof cadmium-plated fasteners.

G. Accessible parking Sign Schedule:
   1. Accessible parking stall sign: RESERVED PARKING with international accessibility symbol. Sign color blue with white boarder and figures. Comply with State of Oregon requirements.
   2. Van Accessible parking stall sign: Same as above, provide with added words VAN ACCESSIBLE. Comply with State of Oregon requirements.

2.07 WALL LABELS

A. Fire-Rated Wall Labels:
   1. Use self-adhering labels; Polyester label with text not less than 3 inch high and sroke weight of 3/8 inch; water-proof; white background with black text.
   2. Apply to wall surface, above ceilings, at approximately 15 foot spacings for entire length of rated assembly.
   3. Label Text: FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 TRAINING

A. Provide training to Owner representatives. Demonstrate operation of software, text and display editing, and other features.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:
   1. If no location is indicated obtain Owner's instructions.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION 10 1400

SECTION 10 2113.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Concealed steel support members.

B. Section 09 2113 - Gypsum Board Assemblies: Metal wall and ceiling framing, backing and blocking.

C. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 6 by 6 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bobrick Washroom Equipment, Inc: www.bobrick.com. Basis of Design: Duraline 1082 Series by Bobrick.

B. Substitutions: Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Toliet Compartments Configuration: Solid phenolic core, laminate finished, floor mounted, overhead braced.

B. Doors, panels and pilasters: Laminate finish surface, solid phenolic core with no voids, beveled corners and edges; edges of cut-outs sealed.
   1. Reinforce pilasters and panels with steel plate sandwiched in particleboard core at attachement points.Router cut openings as required.
   2. Plastic Laminate color: See finish legend on drawings

C. Doors:
   1. Thickness: 3/4 inch.
   2. Width: 24 inch.
   3. Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 58 inch.

D. Panels:
   1. Thickness: 1/2 inch.
   2. Height: 58 inch.

E. Pilasters:
   1. Thickness: 3/4 inch.
   2. Height: 82 inch
   3. Width: As required to fit space; minimum 3 inch.

F. Urinal Screens: Wall mounted with continous panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 4 inch high, concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
   2. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.

B. Head Rails: Hollow stainless steel tube, 1 1-5/8 inch size, anti-grip strips and cast socket wall brackets..

C. Wall Brackets: Stainless steel; continuous type, satin.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

E. Hardware, Satin Stainless Steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Nylon bearings
   3. Thumb turn door latch with exterior emergency access feature.
   4. Heavy duty door stricke and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pulls for outswinging doors.
   7. Door Latch: Track of door latch prevents inswing doors from swinging out beyond stile; on outswing doors, door keeper prevents door from swinging in beyond stile; 16 gauge sliding door latch, 14 gauge keeper.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 PREPARATION

A. Prepare substrates including but not limited to blocking and supports in walls and ceilings at points of attachment using methods recommended by the manufacturer for achieving the best result for the substrates under the project conditions.
   1. Inspect areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
   2. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

C. Do not proceed with installation until substrates have been properly prepared with blocking and supports in walls and ceilings at points of attachment and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.03 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.05 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10 2113.19

SECTION 10 2123
CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface mounted overhead curtain track and guides.

B. Cubicle curtains.

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings: Suspended ceiling system to support track.

1.03 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for curtain fabric characteristics.

C. Samples: Submit 12 by 12 inch sample patch of curtain cloth with representative top, bottom, and edge hem stitch detail, heading with reinforcement and carrier attachment to curtain header.

D. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept curtain materials on site and inspect for damage.

B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cubicle Track and Curtains:
   1. A. R. Nelson Co: www.arnelson.com/#sle.
   2. Construction Specialties, Inc; Track Systems: www.c-sgroup.com/#sle.
   3. Imperial Fastener Co., Inc: www.imperialfastener.com/#sle.
   4. Inpro: www.inprocorp.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRACKS AND TRACK COMPONENTS

A. Tracks: Extruded aluminum sections; one piece per track run.
   1. Profile: Channel.
   2. Mounting: Surface.
   3. Track End Stop: To fit track section.
   4. Finish on Exposed Surfaces: Clear anodized.

B. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.

C. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.03 CURTAINS

A. Cubicle Curtains:
   1. Inherently flame resistant; capable of passing NFPA 701 test.
   2. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.
      a. Fabric: Maharam, Wink
   3. Color/Pattern: 511491-004 Grow.

4. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, manufacturer's standard color.
5. Attachment of Curtain Fabric to Open Mesh Cloth: Manufacturer's standard sewn seam.

B. Curtain Fabrication:
1. Width of curtain to be 15 percent wider than track length.
2. Length of curtain to end 10 inches above finished floor.
3. Include open mesh cloth at top 12 inches of curtain for room air circulation, attached to curtain as specified above.
4. Curtain Heading: Fabric band matching curtain panel with metal grommet holes for carriers spaced 6 inches on center.
5. Seams and Hems: Manufacturer's standard fabrication method for securely sewn and finished seams and hems.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install curtain track to be secure, rigid, and true to ceiling line.

B. Secure track to ceiling system.

C. Install end cap and stop device.

D. Install curtains on carriers ensuring smooth operation.

END OF SECTION 10 2123

SECTION 10 2601

WALL AND CORNER GUARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Wall protection plates

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Anchors for attachment of work of this section, concealed in wall.

B. Section 09 9600 - High Performance Coatings: For painted corner guards

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Indicate physical dimensions, features, and anchorage details.

C. Shop Drawings: Include plans, elevation, sections, and attachment details.

D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall and Corner Guards:
   1. Wall-Guard; www.wallguard.com
   2. Construction Specialties, Inc: www.c-sgroup.com/#sle.
   3. Inpro: www.inprocorp.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Protection Plates:
   1. Inpro: www.inprocorp.com.
   2. Construction Specialties, Inc: www.c-sgroup.com/
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Corner Guards: Flush Mounted (CG-1), Stainless steel, Type 304, number 4 satin finish.
   1. Thickness: 16 gage.
   2. Length: See drawings.
   3. Locations: See Drawings.
   4. Size: 2 inches x 2 inches, similar to Inpro Product Stainless Steel Flush Mount Corner Guards

B. Corner Guards: Surface Mounted (CG-3): Stainless steel, Type 304, number 4 satin finish.
   1. Thickness: 16 gage
   2. Length: See drawings.
   3. Size: 2 inches x 2 inches, similar to Inpro Surface Mount Stainless Steel Corner Guard
   4. Angle: Sharp 90 degree legs, undrilled.
   5. Locations: Where indicated on drawings.

C. Endwall Cap: Flush mounted (CG-2): Stainless steel, type 304, number 4 satin finish.
   1. Size: 2 inch legs similar to Inpro Product Stainless Steel Flush Mount End Wall Protector
   2. Corners: 1/8 inch radius.
   3. Thickness: 16 gage.
   4. Length: See drawings.
   5. Locations: Where indicated on drawings.

D. Endwall Cap: Surface mounted (CG-4): Stainless steel, type 304, number 4 satin finish.
   1. Size: 2 inch legs similar to Inpro Product Surface Mount Stainless Steel End Wall Protectors
   2. Corners: 1/8 inch radius.
   3. Thickness: 16 gage.
   4. Length: See drawings
   5. Locations: Where indicated on drawings.
   6. Applied Finish: Apply High Performance Coating to match wall paint corner guard is installed on.

E. Stainless Steel Wall Panels:
   1. Product: Similar to Inpro Product Stainless Steel Pre-Fabricated Panels
   2. Material: Type 304 stainless steel, No. 4 satin finish
   3. Finish: Smooth
   4. Panel Thickness: 18 gauge
   5. Panel Size: As indicated on Drawings
   6. Mounting: Heavy duty adhesive

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Form end trim closure by capping and finishing smooth.

C. De-burr and dull any exposed edges for safety.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Position corner guard as indicated on drawings.

C. Apply a bead of Heavy Duty Adhesive in a zigzag pattern over the back of each wing of the corner guard. Position corner guard on the wall and apply pressure until a tight fit is achieved.

D. Remove the protective plastic covering from the exposed surface of the corner guard.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

END OF SECTION 10 2601

SECTION 10 2800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Diaper changing stations.

D. Custodial room accessories.

E. Grab bars.

F. Installation of Accessories furnished by Owner.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Concealed supports for accessories, including in wall framing and plates.

B. Section 09 3000 - Tiling: Ceramic washroom accessories.

C. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

E. ASTM C1036 - Standard Specification for Flat Glass; 2016.

F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

G. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004, with Editorial Revision (2016).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS OF CONTRACTOR FURNISHED AND CONTRACTOR INSTALLED ITEMS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc: www.americanspecialties.com/#sle.
   2. Bradley Corporation: www.bradleycorp.com/#sle.
   3. Substitutions: Section 01 6000 - Product Requirements.

B. All items of each type to be made by the same manufacturer.

C. Provide products of each category type by single manufacturer.

2.02 OWNER-FURNISHED AND CONTRACTOR INSTALLED ITEMS

A. Coordinate blocking/backing inside walls and install owner-furnished items listed at the end of Part 3 of this section.

2.03 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide one key for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Adhesive: Two component epoxy type, waterproof, compliant with project VOC limitations.

G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.04 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.05 COMMERCIAL TOILET ACCESSORIES

A. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Size: As indicated on drawings.
   2. Frame, where indicated: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   4. Mirror M-1: B-290 manufactured by Bobrick.
   5. Type: Framed.
   6. Size: as indicated on drawings.

B. Grab Bars: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.
      d. Products:
         1) GB-1: 36 inches, similar to Bobrick 5806.
         2) GB-2: 42 inches, similar to Bobrick 5806.
         3) GB-3: 18 inches, similar to Bobrick 5806.
         4) GB-4: Two wall, wrap-around type, similar to Bobrick B-58616

C. Combination Sanitary Napkin/Tampon Dispenser: Stainless steel, semi-recessed.
   1. Door: Seamless 0.05 inch door with returned edges and tumbler lock.
   2. Operation: No charge; no coin slots.
   3. Identify dispensers slots without using brand names.
   4. Minimum capacity: 20 napkins and 30 tampons.
   5. Product: B-370634C manufactured by Bobrick.

D. Wall Hook: Heavy-duty stainless steel, single-pronge, circular-shaped bracket and backplate for concealed attachment, satin finish.
   1. Product: B-9542 manufactured by Bobrick.

E. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Style: Horizontal.
   2. Material: Stainless Steel
   3. Mounting: Surface.
   4. Color: Gray.
   5. Minimum Rated Load: 250 lbs.
   6. Product: KB200-SS by Koala Kare Products, Division of Bobrick.

2.06 CUSTODIAL ROOM ACCESSORIES

A. Combination Utility Shelf, Mop and Broom Holder: 0.05 inch thick stainless steel, type 304 with 1/2 inch returned edges, 0.06 steel wall brackets.
   1. Drying Rod: Stainless steel 1/4 inch diameter.
   2. Hooks: Quantity of 4. Size: 0.06 inch stainless steel rag hooks.
   3. Mop/Broom Holders: 3 spring loaded rubber holders.
   4. Length: 34 inches.
   5. Manufacturer and Model: B-239 by Bobrick.

2.07 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter unless otherwise indicated, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners.
   1. Product: B-6107 manufactured by Bobrick.
   2. Length: 36 inches.

B. Shower Curtain:
   1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
   2. Size: 72 by 72 inches, hemmed edges.
   3. Grommets: Stainless steel; pierced through top hem on 6 inch centers.
   4. Color: White.
   5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
   6. Product: 204-2 curtain with 204-1 hooks manufactured by Bobrick.

C. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
   1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
   2. Size: ADA Standards compliant.

D. Wall-Mounted Soap Dish: Heavy duty, seamless stainless steel, surface-mounted with drain holes, without grab bar, satin finish; with concealed mechanical fastening suitable for substrate and backplate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install Owner furnished items as recommended by manufacturer and as indicated.

C. Install plumb and level, securely and rigidly anchored to substrate, in locations indicated on drawings.

D. Mounting Heights: As indicated on drawings and required by accessibility regulations, unless otherwise indicated.

E. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

3.05 INSTALLATION OF OWNER-FURNISHED ACCESSORIES

A. Install the following accessories provided by Owner:
   1. Electric hand drier; surface-mount. Provide electrical connection.
   2. Paper towel dispenser; surface-mounted.
   3. Toilet Paper dispenser; surface-mounted.
   4. Soap dispenser, surface-mounted.
   5. Toilet seat cover dispenser, surface-mounted.
   6. Sanitary napkin disposal, surface-mounted.
   7. Waste Receptacle

END OF SECTION 10 2800

SECTION 10 4300
EMERGENCY AID SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automated external defibrillators (AEDs).

B. Automated external defibrillator (AED) cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Openings and blocking.

1.03 DEFINITIONS

A. Automated External Defibrillator (AED): A Food and Drug Administration (FDA)-approved portable device, which automatically analyzes the heart rhythm and recognizes the presence of ventricular fibrillation and/or tachycardia. If defibrillation is warranted, the AED automatically charges and prompts (visual and/or audio) the operator to deliver an electrical shock.

1.04 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide AED operational features, color and finish, anchorage details, and installation instructions.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Automated External Defibrillators (AEDs):
   1. Philips Medical Systems: www.usa.philips.com/#sle.
   2. Stryker Corporation; HeartSine samaritan PAD 350P Defibrillator - PAD 350p: www.stryker.com/#sle.
   3. ZOLL Medical Corporation: www.zoll.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Emergency Aid Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries; LifeStart 1400 Series AED Cabinet: www.activarcpg.com/#sle.
   2. Modern Metal Products, a division of Technico, Inc: www.modern-metal.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 AUTOMATED EXTERNAL DEFIBRILLATORS (AEDS)

A. Automated External Defibrillators (AEDs) - General: FDA approval required.
   1. Provide automated external defibrillators (AEDs) as indicated.

2.03 EMERGENCY AID CABINETS

A. Type: Automated external defibrillator (AED).

B. Cabinet Construction: Non-fire-rated.
   1. Formed stainless steel sheet; 0.036 inch thick base metal.

C. Cabinet Configuration: Recessed type.
   1. Size to accommodate AED.

2. Trim: Flat square edge, with 2 inch wide face.
3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

D. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with wire pull handle and nylon catch. Hinge door for 180 degree opening with two butt hinges.

E. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

F. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

G. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

2.04 ACCESSORIES

A. Cabinet Door Signage: "AED" decal, or vinyl self-adhering, prespaced black lettering and identifying graphic in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place AEDs in cabinets.

D. Cabinet Lettering:
1. Location: Face of door framing.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate smoothly without binding. Verify that alarms and integral locking devices operate properly.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals for closeout submittals.

B. Demonstrate proper operation of AED to Owner's designated representative.

END OF SECTION 10 4300

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.
   3. Potter-Roemer: www.potterroemer.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguisher in each cabinet and elsewhere where shown on Drawings.

B. Multi-Purpose Dry Chemical Type Fire Extinguishers: Heavy duty steel tank, with pressure gage.
   1. UL Class: A:B:C.
      a. 4-A:60B:C, 10 pound (Similar to JL "Cosmic 10E").
   2. Finish: Factory powder-coated; Red.
   3. Contents: Fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic

2.03 FIRE EXTINGUISHER CABINETS

A. Similar to JL Industries Cosmopolitan C1837V17.

B. Cabinet Configuration: Recessed type.
   1. Sized to accommodate extinguisher and accessories.
   2. Projected Trim: Returned to wall surface, with 3/8 inch projection, and 1 3/4 inch wide face.

C. Tub: Primed sheet steel, powder-coated finish.

D. Door: 0.036 inch thick stainless steel reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide nylon catch.

E. Door Glazing: Float glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

G. Fabrication: Weld, fill, and grind components smooth.

H. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

I. Finish of Cabinet Interior: White colored enamel.

2.04 FIRE DEPARTMENT LOCK BOX

A. Manufacturer
   1. KNOXBox www.knoxbox.com/

B. Model: KNOXBox 3200 Series - Surface Mounted, Black.

C. Key to master key system of fire department having jurisdiction at building site.

D. Surface mount on wall near front entrance, 60 inches above finished floor, where shown on Drawings or as directed by Architect.

2.05 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished, red.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, maximum 54 inches from finished floor to inside top of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

3.03 FIELD QUALITY CONTROL

A. Ensure that each extinguisher is fully charged, and that inspection of each extinguisher has been performed, as evidenced by the National Association of Fire Equipment Distributors certification tag, just prior to turnover.

END OF SECTION 10 4400

SECTION 10 5100
LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lockers.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood base construction.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, attachment points.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lockers:
   1. List Industries: www.listindustries.com
   2. Lyon Workspace Products: www.lyonworkspace.com.
   3. Penco Products, Inc: www.pencoproducts.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOCKER APPLICATIONS

A. Wardrobe Lockers at Kitchen C118: Two tier metal lockers, free-standing with matching closed base.
   1. Width: 12 inches.
   2. Depth: 18 inches.
   3. Height: 72 inches.
   4. Fittings: Hat shelf, 1 double prong coat hook.
   5. Ventilation: Louvers at top and bottom of door panel.
   6. Locking: Padlock hasps, for padlocks provided by Owner.
   7. Provide sloped top.

B. Lockers At Restroom C124 : Single tier metal lockers, free-standing with matching closed base.
   1. Width: 15 inches.
   2. Depth: 18 inches.
   3. Height: 72 inches.
   4. Fittings: Hat shelf, 2 coat hooks.
   5. Locking: Built-in combination locks.
   6. Provide sloped top.

2.03 METAL LOCKERS

A. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
   1. Where ends or sides are exposed, provide flush panel closures.
   2. Provide filler strips where indicated, securely attached to lockers.
   3. Color: To be selected by Architect.

B. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
   1. Body and Shelves: 24 gage, 0.0239 inch.
   2. Base: 20 gage, 0.036 inch.
   3. Metal Base Height: 4 inch.

C. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
   1. Door Frame: 16 gage, 0.0598 inch, minimum.

D. Doors: Hollow channel edge construction, 1-3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
   1. Door Outer Face: 18 gage, 0.0478 inch, minimum.
   2. Door Inner Face: 20 gage, 0.0359 inch, minimum.
   3. Form recess for ADA-compliant operating handle and locking device.
   4. Provide louvers in door face, top and bottom, for ventilation.

E. Hinges: Two for doors under 42 inches high; three for doors over 42 inches high; weld securely to locker body and door.
   1. Hinge Thickness: 14 gage, 0.0747 inch.

F. Sloped Top, where indicated: 20 gage, 0.036 inch, with closed ends.

G. Trim: 20 gage, 0.0359 inch.

H. Coat Hooks: Stainless steel or zinc-plated steel.

I. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 1/2 inch high of block font style with ADA designation, in contrasting color.

J. Provide ADA signage at lockers designated as accessible.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Place and secure on prepared base.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install accessories.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION 10 5100

SECTION 10 7500

FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

B. Flags

1.02 RELATED REQUIREMENTS

A. Section 01 6211 - Delegated Design:Design-build requirements.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2016.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

D. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

D. Delegated Design:Provide structural design and calculations for foundation as required buy Authorities Having Jurisdiction.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed the State in which the Project is located.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:.
   1. American Flagpole: www.americanflagpole.com.
   2. Concord Industries, Inc: www.concordindustries.com.
   3. Pole-Tech Co, Inc: www.poletech.com.
   4. Eagle Mountain Flag & Flagpole Company: www.eaglemountainflag.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001.
   1. Material: Aluminum.
   2. Design: Straight shaft.
   3. Mounting: Ground mounted type.
   4. Outside Tip Diameter: 3-1/2 inches

5. Nominal Wall Thickness: 0.188 inches.
6. Nominal Height: 35 ft; measured from nominal ground elevation.
7. Nominal Height: 40 ft; measured from bottom.
8. Design: Cone tapered.
9. Halyard: External type.

B. Performance Requirements:
1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 90 miles/hr wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.03 POLE MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch diameter, gold anodized finish.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Flag: US design, 5 ft by 8 ft size, embroidered nylon fabric, brass grommets, hemmed edges.

D. Flag: Oregon State design, 3 ft by 5 ft size, embroidered nylon fabric, brass grommets, hemmed edges.

E. Flag: National League of Families' POW/MIA, 3 ft by 5 ft size, embroidered nylon fabric, brass grommets, hemmed edges.

F. Cleats: 9 inch size, aluminum with galvanized steel fastenings, two per halyard.

G. Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

H. Halyard: 5/16 inch diameter polypropylene, braided, white.

2.05 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gauge, 0.0598 inch steel, galvanized, depth of inches as indicated.

2.06 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Aluminum: Mill finish.

C. Finial: Spun finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole and fittings in accordance with manufacturer's instructions.

B. Set brackets for wall set flagpoles anchored securely into wall construction. Seal watertight.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

3.05 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION 10 7500

SECTION 11 3013
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping: Plumbing connections for appliances.

B. Section 26 0583 - Wiring Connections: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. Refrigerator, Type REF-1: Free-standing, side-by-side, and frost-free.
   1. Capacity: Total minimum storage of 18 cubic ft; minimum 15 percent freezer capacity.
   2. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by U.S. Department of Energy (DOE).
   3. Features: Include glass shelves, automatic icemaker, light in freezer compartment, and in-door water and ice dispenser.
   4. Exterior Finish: Stainless steel.
   5. Manufacturers:
      a. Frigidaire Home Products: www.frigidaire.com/#sle.
      b. GE Appliances: www.geappliances.com/#sle.
      c. Whirlpool Corp: www.whirlpool.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Refrigerator, REF-2: Under-counter, ADA compliant
   1. Capacity: Total minimum storage of 5.5 cubic ft.
   2. Size: 24 inches wide x 32 inches high.
   3. Connection: 120 volt
   4. Features: Include glass shelves

5. Finish: Stainless steel
6. Product:
    a. Model AL54 by Summit Appliances: www.summitappliance.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements

C. Microwave: Countertop.
1. Capacity: 2.2 cubic ft.
2. Power: 1200 watts.
3. Features: Include turntable.
4. Exterior Finish: Stainless Steel.
5. Manufacturers:
    a. Frigidaire Home Products: www.frigidaire.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

D. Dishwasher: Undercounter. ADA Compliant.
1. Size: 24 inches wide x 32-1/4 inches high, 22 inch depth.
2. Controls: Solid state electronic; ADA compliant
3. Wash Levels: Three (3).
4. Cycles: Six (6), including normal, rinse and hold, short, china/crystal, and pot and pan.
5. Features: Include rinse aid dispenser.
6. Finish: Stainless steel.
7. Product:
    a. Model #SGE53X55UC by Bosch: www.bosch.us
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LAUNDRY APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Clothes Washer, CW-1: Top-loading stationary.
1. Size: 3.2 cubic ft.
2. Controls: Solid state electronic.
3. Connection: 120 Volt, 15 amp
4. Finish: Painted steel, color white.
5. Product:
    a. Speed Queen Model TR3000WN: www.speedqueen.com
    b. Substitutions: Not permitted.

C. Clothes Dryer, CD-1: Electric, Top- loading, stationary.
1. Size: 7.0 cubic ft.
2. Controls: Solid state electronic, with electronic moisture-sensing dry control.
3. Connection: 220 volt, 12 amp, 2800 watt
4. Finish: Painted steel, color white.
5. Product:
    a. Speed Queen Model DR3000WE:www.speedqueen.com
    b. Substitutions: Not permitted.

D. Stacked Washer/ Dryer
1. Size:
    a. Dryer: 7.0 cubic ft.
    b. Washer: 3.5 cubic ft.
2. Controls: Electronic Homestyle
3. Connection: 220 volt
4. Finish: Painted steel , color white.
5. Product:
    a. Speed Queen Model SF7003WE: www.speedqueen.com.
    b. Substitutions: Not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION 11 3013

SECTION 11 4000

FOOD SERVICE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES: FOOD SERVICE EQUIPMENT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and Division 1 Specification Sections apply to this Section.

1.02 RELATED WORK

A. Rough-ins and Final Connections: Service lines from rough-in to point of final connections are provided by plumbing and electrical contractors.

B. Electrical: Wiring, conduit, fuses, breakers, final disconnects, junction boxes, and other required electrical apparatus not built-in or mounted on equipment are provided by electrical contractor.

C. Plumbing: Controls, regulators, valves, stops, traps, strainers, checks, grease traps, and fittings not mounted on/in equipment are provided by plumbing contractor.

D. Mechanical: Ductwork from above finished ceiling to building exhaust and supply fans, flue pipes, exhaust and supply fans for hoods, room ventilation, and air supply blowers are provided by mechanical contractor.

E. Miscellaneous
   1. Provides backing plates or blocking in wall or ceiling partitions.
   2. Provides fittings secured to structural ceiling to accommodate hangers.
   3. Provides the forming of architectural enclosures, floor, wall openings or recesses for equipment.
   4. Caulks and seals Cold Storage Room floor sections to building floor.
   5. Finishes floors (masonry or poured-in-place) in cold storage rooms, concrete curbs and pads.

1.03 SYSTEM DESCRIPTION

A. Delegated Design: Design canopy hoods with fire protection system, walk-in cold storage rooms, and seismic restraint of equipment using performance requirements and design criteria indicated, including comprehensive engineering analysis by a qualified professional engineer licensed by the State.

B. Fabricated Equipment: Constructed to configuration, dimension, detail, and design as shown with materials and workmanship as specified.

C. Manufactured Equipment: Mass produced and referenced by manufacturer's name and model number.

D. Each model number includes the code *H011 as a suffix. This code is known as the Specified Identification System. It is not to be removed by the bidders. Its purpose is to identify the Food Service Consultant to the vendors providing equipment in the event it is necessary to communicate questions, clarifications, and comments, from prior to bid award through the final purchase. It is to be used on all correspondence, including fax and e-mail, when communicating with manufacturer representatives and factories.

1.04 DEFINITIONS

A. Furnish - Supply and deliver to Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

B. Install (set in place) - Work at Project Site, including actual unloading, unpacking, assembly, erecting, rigging, placing, anchoring, applying, finishing, curing, protecting, cleaning, and similar operations, ready for final utility connections by other Sections as appropriate.

C. Coordinate – Relay required information requested by other trades to ensure they are able to correctly perform their work related to the food service or laundry equipment installation.

D. Provide - Furnish and install complete, ready for intended use.

E. Contractor - All references to the Contractor in this Section 114000 shall refer to the Contractor. Reference to any other Contractor shall be specific, such as General Contractor, Plumbing Contractor, Electrical Contractor, Architect, designated, etc.

1.05 LAWS, ORDINANCES AND STANDARDS

A. STANDARDS: Except as otherwise indicated, comply with the following standards as applicable to the manufacture, fabrication, and installation of the work of this Section:

1. Air Conditioning and Refrigeration Institute (ARI): Comply with the applicable regulations and references of the latest edition of standards for remote refrigeration system(s), components, and installation.
2. American Gas Association (AGA): Comply with AGA standards for gas heated equipment and provide equipment with the AGA seal. Automatic safety pilots shall be provided on all equipment, where available. (Canadian Gas Association or alternate testing lab's seals may be accepted if acceptable to local code jurisdictions.)
3. American National Standards Institute (ANSI): Comply with ANSI Z21-Series standards for gas-burning equipment and provide labels indicating name of testing agency.
4. American National Standards Institute (ANSI): Comply with ANSI B57.1 for compressed gas cylinder connections and with applicable standards of the Compressed Gas Association for compressed gas piping.
5. American National Standards Institute (ANSI): Comply with ANSI A40.4 and A40.6 for water connection air gaps and vacuum breakers.
6. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE): Comply with the applicable regulations and the latest edition of standards for remote refrigeration system(s), components, and installation.
7. American Society of Mechanical Engineers (ASME): Comply with ASME Boiler Code requirements for steam generating and steam heated equipment and provide ASME inspection, stamp, and registration with National Board.
8. American Society for Testing and Materials (ASTM): Comply with ASTM C1036 for flat glass.
9. American Society for Testing and Materials (ASTM): Comply with ASTM C1048 for heat-treated flat glass – Kind HS, Kind FT coated and uncoated glass.
10. American Welding Society (AWS): Comply with AWS D1.1 structural welding code.
11. National Electric Code (NEC): Comply with NFPA Volume 5 for electrical wiring and devices included with food service equipment, ANSI C2 and C73, and applicable NEMA and NECA standards.
12. National Electrical Manufacturers Association (NEMA): Comply with NEMA LD3 for high-pressure decorative laminates.
13. National Fire Protection Association (NFPA): Comply with the applicable sections of the NFPA for exhaust hood, ventilators, duct and fan materials, hoods fire suppression systems, construction and installation, as well as local codes and standards.
14. National Sanitation Foundation (NSF): Comply with the latest Standards and Revisions established by NSF for equipment and installation. Provide NSF Seal of Approval on each applicable manufactured item and on items of custom fabricated work. (UL Sanitation approval and seal may be accepted if acceptable to local code jurisdictions.)
15. Sheet Metal and Air Conditioning National Association (SMACNA): Comply with the latest edition of SMACNA guidelines for seismic restraint of kitchen equipment and applicable local regulatory agencies requirements.
16. Underwriters Laboratories (UL): Provide either UL labeled products for electrical components and assemblies or, where no labeling service is available, "recognized markings" to indicate listing in the UL "Recognized Component Index". (Canadian Standards Association or alternate testing lab's seals may be accepted if acceptable to local code jurisdictions.)
17. UL 300 Standard: Wet chemical fire suppression systems for exhaust hoods/ventilators shall comply with these requirements.

18. American with Disabilities Act (ADA): Comply with requirements as applicable to this Project.
19. Refrigeration Service Engineers Society (RSES): Comply with the applicable regulations, the latest edition of standards for remote refrigeration system(s), components and installation, and the 1995 requirements of the Montreal Protocol Agreement.
20. All refrigerants used for any purpose shall comply with the 1995 requirements of the Montreal Protocol Agreement and subsequent revisions and amendments. No CFC refrigerants shall be allowed on this Project.
21. All refrigeration components installation, repairs, and/or associated work on any refrigeration system, self-contained or remote, shall be performed by a Certified Refrigeration Mechanic.
22. Comply with all applicable local codes, standards and regulations, and any special local conditions (example only: City of Los Angeles Testing Lab requirements or seismic standards compliance).
23. Jails, prisons, and all detention facilities shall comply with Correctional Standards as applicable to the specific Project. Verify the level of security and construction required with the Project Architect and provide all items in compliance. As a minimum, no part or component of any item provided shall be easily removable and used as a weapon.
24. Subway grating installed in floor drain troughs must meet IBC 1104.3.1 standards for maximum opening sizes in grates.
25. Confirm all drawings, specifications, and project documentation meet all federal, state, and local codes and regulations.

1.06 CONTRACTOR QUALIFICATIONS

A. In addition to requirements of Related Sections 1.02, submit evidence of compliance with the following qualifications and conditions:
   1. Five (5) years minimum continuous operation under the same company name and ownership.
   2. Evidence of Company's financial stability and financial ability to complete this Project without endangering that stability.
   3. List a minimum of comparable size and scope projects completed in the last five (5) years with Owner's contact name and telephone number.
   4. Have manufacturer's authorization to purchase, distribute, and install all items specified with this Project.
   5. Maintain a staff or have access to personnel with a minimum of five (5) years' experience in the installation of comparable size and scope projects, and meeting NSF standards and requirements. (UL Sanitation standards and requirements may be accepted if acceptable to local code jurisdictions.)
   6. Maintain or have access to a fabrication shop meeting NSF standards and labeling requirements. (UL Sanitation approval and seal may be accepted if acceptable to local code jurisdictions.) If other than the Contractor's own fabrication shop, they shall have five (5) years minimum experience in the fabrication of comparable size, scope, and level of quality projects. The Contractor shall submit their company name and credentials to the Architect, who shall have the right of approval or disapproval
   7. Maintain a staff or have access to personnel experienced in the preparation of professional style shop drawings and submittals.
   8. Maintain or have access to manufacturer's authorized service personnel together with readily available stock of repair and replacement parts.
   9. Any sub-Contractor employed by Contractor for this Project shall comply with the same qualification requirements.

1.07 SUBSTITUTIONS

A. Refer to Division 1 for Substitution Request requirements.

1.08 APPROVED SUBSTITUTIONS AND/OR LISTED ALTERNATES

A. Substitutions approved as noted in article 1.07 and/or any Listed Alternate Manufacturers listed in these Itemized Specifications or added by Addendum may be utilized in lieu of the primary specified manufacturer with the following conditions and understanding:
   1. The Project Documents are designed and engineered using the primary specified manufacturer and model. The Contractor shall assume total responsibility for any deviations required due to the utilization of a substitution/alternate manufacturer or model including, but not limited to, fitting alternates into the available space, providing directions for required changes, and assuming any and all associated costs for utility, building, food service design, architectural, or engineering changes directly or indirectly related to the substitution.
   2. The Contractor shall be responsible for supplying the model, which is equal to the primary specified model in regard to general function, features, options, sizes, accessories, utility requirements, finish, operation, and listing approvals. If the Owner or their appointed representative determines at any time during the construction and installation, prior to the final acceptance of the Project, that the substitution/alternate model submitted is not equal to the primary specified model, the Contractor shall assume all associated cost and implications required to replace the model submitted with the correct model.
   3. The bid proposal shall clearly state any substitutions/alternates which will be utilized, including the manufacturer and model number. The proposal shall also include a data sheet for each substitution/alternate with any and all deviations between the primary specified manufacturer and the substitution/alternate manufacturer itemized and listed on the data sheet. The manufacturers' cut sheets are not acceptable as a substitute for the data sheet. Complex alternates, such as utility distribution systems, exhaust hoods, ventilators, etc., shall include a shop drawing specific to the Project.
   4. Inclusion of an alternate manufacturer in the Itemized Specifications is not intended to indicate that there is an equal alternate unit to match every primary specified unit. It shall be the responsibility of the Contractor to ensure that the alternate unit submitted matches the primary specified unit and meets the other conditions, as stated above.
   5. Manufacturers not approved as substitutions or listed as a Listed Alternate will not be permitted unless submitted for prior approval, as described above and in the General and Supplementary Conditions and applicable Division-1 Specifications Sections.
   6. Submittal of a substitution/alternate manufacturer or model shall indicate agreement to the above stated conditions. Solely at the Owner's discretion, failure to comply with any of these conditions or to supply complete and correct data information shall result in the Contractor being required to provide the primary specified manufacturer at no additional cost to the Owner or to adjust the Contract cost.

1.09 DISCREPANCIES

A. Where discrepancies are discovered between the drawings and the specifications regarding quality or quantity, the higher quality or the greater quantity shall be included in the Bid Proposal. The Contractor shall notify the Architect, in writing, of any discrepancies discovered and await clarification prior to proceeding with the items or areas in question.

1.10 SUBMITTALS

A. The Contractor shall review all submittals for basic compliance with the Contract Documents and correct as required prior to submitting to the Design Team (Architects/Engineers/ Consultants/Owner) for review. Failure to comply with this requirement, the submission of submittal(s) which are significantly inconsistent with the Contract Documents, or inconsistencies that are discovered during review by a Design Team member shall be justification for reimbursement by the Contractor to the Design Team member's company for the "lost" time or for the time required for a second review.

B. Rough-In Drawings
   1. Submit electronic PDF file for approval. After approval, reproduce and supply the required number of distribution prints for record and construction purposes.

2. Submit 1/4 inch (1:50) scale rough-in drawings for approval. These drawings shall be dimensioned from grid lines showing location of ducts, stubs, floor and wall sleeves for ventilation, plumbing, steam, electrical, refrigeration lines, beverage lines, concrete base and curb dimensions as required for equipment so supported.
3. Site-verify mechanical, electrical and ventilating rough-in and sleeve locations.
4. The Contractor shall be responsible for the accuracy of the information on their submittals.
5. In the event rough-ins have been accomplished before the award of this contract, the Contractor shall check the existing facility and make adjustments to their equipment to suit building conditions and utilities, where possible. If not possible, the Contractor shall so state in a letter to the Owner and Architect with reasons and an alternate method and pricing.

C. Shop Drawings
1. Submit electronic PDF file for approval. After approval, reproduce and supply the required number of distribution prints for record and construction purposes.
2. Submit shop drawings for items of custom fabrication included in this contract. Shop drawings shall be submitted at 3/4 inch (1:20) and/or 1-1/2 inch (1:10) scale and shall show dimensions, materials, details of construction, features and options, installation and relation of adjoining work requiring cutting or close fitting. Shop drawings shall also indicate reinforcements, anchorage and related work required for the complete installation of fixtures.
3. Before proceeding with the fabrication of any item, the Contractor shall be responsible for verifying and coordinating all dimensions and details with site dimensions and conditions.

D. Product Data Submittal Manuals
1. Submit electronic PDF file of Product Data Submittal Manuals with a cover sheet and detailed information on every item included in this Section for approval. Detailed information shall include, but not be limited to, item number, description, quantity, model numbers, options and accessories provided, exact utility requirements, manufacturer's cut-sheets, reference to specific shop drawings, etc. Distribute one additional copy of installation and start-up instructions to the Installer. Mark each data sheet with the applicable project equipment item number. Each data sheet shall include NEMA plug and receptacle configuration for applicable items, where applicable. Every cover sheet and associated detailed submittal shall provide sufficient and complete information to verify that the Contractor is providing each item in compliance with the Contract documents.
2. Architect review of drawings, shop details, product data brochures, and service and parts manuals are for general conformance with the design concept and contract documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the contract documents or departures there from. The Contractor remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly, and for performing their work in a safe, satisfactory, and professional manner.

1.11 OPERATION AND MAINTENANCE DATA MANUALS

A. Operation and Maintenance Manuals (Service and Parts Manuals): Three (3) bound sets of manuals shall be furnished for items of standard manufacture on/or before the date of the first event to occur of the following: demo/start-up, start-up for intended use by the Owner/Operator, completion of installation of kitchen equipment contract package, or final acceptance of installation by Owner. Manuals shall be in alphabetical order according to manufacturer, including item numbers and utility options provided for the equipment installed.
1. Installing company’s name, address, telephone number, and date of completed installation.
2. Serial numbers of principal pieces of equipment.
3. Part numbers of all replaceable items.
4. Lubrication data and belt sizes.
5. Electrical characteristics including data for motors and heaters.

B. Service Agency List: Submit a complete list of local service agencies with the service and parts manuals for included manufacturers, complete with telephone numbers for all buy-out equipment installed.

C. Provide video tapes for maintenance, training, operation, etc. where available from the manufacturer.

1.12 AS-BUILT/ RECORD DOCUMENTS

A. Maintain one record set of Food service Equipment Plans with any related corrections, revisions, additions, deletions, changes, etc. noted during construction and installation. Provide an "as-built" set in reproducible transparency form and electronic computer disk form.

B. Provide one (1) final set of Product Data Submittal Manuals with any related corrections, revisions, additions, deletions, changes, etc. noted during construction and installation as a specifications record set.

C. These documents shall be provided on/or before the date of the first event to occur of the following: demo/start-up, start-up for intended use by the Owner/Operator, completion of installation of kitchen equipment contract package, or final acceptance of installation by Owner.

D. Provide two (2) final complete set of Submittals to be retained by Architect as a Record Set.

1.13 SCHEDULE

A. General: Time is of the essence in this agreement. Acceptance constitutes a guarantee that the Contractor can and will obtain materials, equipment, and manpower to permit overall completion of the entire building project on schedule upon notice to proceed. The Contractor shall coordinate their work with the progress schedule, as prepared and updated periodically by the General Contractor or Construction Manager.

B. The Contractor shall notify the Food Service Consultant and the Architect in writing of anticipated delays not within the realm of control of the Contractor immediately upon the Contractor's realization that delays are imminent.

C. The Contractor will not be granted relief for failure to meet schedules or failure of manufacturers to meet promised delivery dates unless the Contractor can establish, in writing, that orders were received by the manufacturer with reasonable lead times.

D. The Contractor shall pay extra charges resulting from special handling or air shipment in order to meet the schedule if insufficient time was allowed in placing factory orders.

1.14 PRODUCT HANDLING

A. Delivery of Materials: Deliver materials (except bulk materials) in manufacturer's containers fully identified with manufacturer's name, trade name, type, class, grade, size, color, power requirement, if any, and item number.

B. Storage of Materials, Equipment and Fixtures: Contractor is responsible for receiving and warehousing of equipment and fixtures until ready for installation. The Contractor will store materials, equipment, and fixtures in sealed containers. They shall be stored off the ground and under cover, protected from damage.

C. Handling Materials and Equipment: The Contractor will verify and coordinate conditions at the building site, particularly door and/or wall openings and passages to assure access for all equipment. Pieces too bulky for existing facilities shall be hoisted or otherwise handled with apparatus as required. All special handling equipment charges shall be arranged for and paid for by the Contractor.

1.15 PRODUCT PROTECTION

A. The Contractor is responsible to protect their equipment against theft or damage during the progress of the project until final acceptance by the Owner. Items delivered to the job site at the Owner's or Contract Manager's request before the site is ready for installation should be signed for as approved by the Owner or Contract Manager.

B. The Contractor will use all reasonable means to protect the materials of this Section before, during, and after installation and to protect the associated work and materials of the other trades.

C. Pre-fabricated walk-in boxes, on-site and installed in advance of the rest of the equipment are not to be used for general storage by other trades and should be locked before leaving the site. Damage and theft resulting from the failure to secure boxes shall be repaired or replaced at the Contractor's own expense. The Contractor shall be available, as needed, to open and secure walk-in boxes for the other trades to perform their work related to these walk-in boxes, within the other trades' schedules as not to delay their work.

D. Contractor will verify if the flooring is to be acid washed. In the event of this type of cleansing, any equipment constructed of stainless steel shall not be delivered until a minimum of 24 hours after the final cleansing is completed.

1.16 WARRANTY

A. Work shall be guaranteed against defects for one (1) year from the date of operation of the equipment. The Contractor will provide a written warranty of each component to include work in this Section to cover all testing and re-testing as may become necessary for one year past the Contract final acceptance date. Any equipment, system, or element failing to perform as directed in this Section shall be repaired or replaced at no cost to the Owner (including labor and transportation), excluding replacement cost of damaged components or work caused by misuse of the equipment.

B. Additional Warranty: Refrigeration systems shall include a start-up and one-year service and maintenance contract in addition to the regular one-year warranty as stated above, plus an additional four-year warranty on sealed portions of condensing units, including refrigerant lost. This shall include all refrigerators, ice cream makers and cabinets, ice makers, freezers, dispensers, walk-in coolers/freezers compressors, and/or any other items with refrigeration system(s).

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Equipment schedule: Refer to schedule on Food service Drawings and Part 2 Itemized Specifications for equipment included in this Section.

2.02 MATERIALS

A. Metals
   1. Stainless Steel: AISI Type 302/304, hardest workable temper, and No.4 directional polish. Standard gauges are noted in these specifications under Heading 2.04; Section B.1.
   2. Galvanized Steel Sheet: ASTM A526, except ASTM A527 for extensive forming; ASTM A525, G90 zinc coating, chemical treatment.

   Note: Where painted finish is indicated, provide mill phosphatized treatment in lieu of chemical treatment.

   3. Steel Sheet: ASTM A569 hot-rolled carbon steel.
   4. Galvanized Steel Pipe: ASTM A53 or ASTM A120, welded or seamless, schedule 40, galvanized.
   5. Steel Structural Members: Hot rolled or cold formed, carbon steel unless stainless steel is indicated.

   Note: Galvanized Finish (G.I.): ASTM A123 hot-dipped zinc coating, applied after fabrication.

   6. Aluminum: ASTM B209B221 sheet, plate and extrusions (as indicated), alloy, temper and finish as determined by manufacture / fabricator, except 0.40-mil natural anodized finish on exposed work unless another finish is indicated.

B. Plastic Laminate: NEMA LD3, Type 2, 0.050" thick, except Type 3, 0.042" for post-forming smooth (non-textured). Color and texture as selected by the Architect/Interior Designer.
   1. Comply with NSF Standard No. 35.

2. Veneered with approved waterproof and heat proof cement. Rubber base adhesives are not acceptable.
3. Applied directly over close grained plywood, such as solid Mahogany or solid Birch, of selected, smooth, sanded stock to ensure a smooth ripple-free laminated surface; or commercial grade furniture particle board, Cortron or equal.
4. If specified plywood or particle board is unavailable, submit specifications and sample of alternate material for approval. If specified for a “wet” area, only marine grade wood products will be approved for these areas.
5. Exposed faces and edges shall be faced with 1/16 inch (1.6mm) thick material. Cover corresponding backs with approved backing and balancing sheet material. No unfinished exposed plywood/particle board will be acceptable.

C. Hardwood Work Surfaces: Laminated edge grained hard maple (Acer saccharum), NHLA First Grade with knots, holes and other blemishes culled out, kiln dried at 8 percent or less moisture, waterproof glue, machined, sanded, and finished with NSF approved oil-sealer.

D. Solid Surface Material (SSM): Unless otherwise specified, provide 1/2" thick 100% homogeneous filled acrylic material meeting ANSI Z124.6 Type 6, as manufactured by DuPont Company and known as Corian. Color(s) and pattern(s) as selected by the Architect/ Interior Designer.
1. Comply with NSF Standard No. 51.
2. Acrylic adhesive shall be used for all joints.
3. Install directly over 3/4" thick (minimum) substrate of close grained plywood, such as solid Mahogany or solid Birch, of selected, smooth, sanded stock to ensure a smooth ripple-free surface or a commercial grade furniture particle board, Cortron or equal. Provide additional bracing and support as required by the SSM manufacturer.
4. Fabrication shall be by a fabricator trained by DuPont factory authorized training personnel and Certified as a Commercial Corian Fabricator.
5. Installation shall be by an installer trained by DuPont factory authorized training personnel and Certified as a Commercial Corian Installer.
6. All fabrication and installation of Corian and all components attached to or installed in or through Corian shall be in compliance with manufacturer's instructions and the DuPont Corian Food Service Guidelines and Design Manual. Of particular concern are the sections, details, and instructions on the installation of drop-in or built-in hot or cold components.
7. All other Solid Surface Material (SSM), which may be specified by others to be used in food service areas, must comply with NSF certification and ANSI Standard No. 51.

E. Insulation
1. For low temperature applications, such as ice bins, cold pans, or fabricated under counter freezers, use urethane, rigid board foam or foamed-in-place, not less than 2 inches (50mm) thick, except that vertical surfaces of cold pans and ice bins may be 1 inch (25mm) thick. Insulation shall be bonded at joints to prevent condensation on exterior.
2. For refrigerated applications, such as fabricated undercounter refrigerators, use urethane rigid board foam or foamed-in-place, or Styrofoam rigid board foam 2 inches (50mm) thick, bonded at joints.
3. For heated type applications, such as plate warmers, use block type rock wool, minimum 1 inch (25mm) thick.
4. At counter tops, subject to heat from cooking equipment and refrigeration compressors, use 1 inch (25mm) thick B&Z Products (1-800-999-0890) Marinite I, or equal, to insulate underside of top.
5. Marinite material shall be added between freezer or refrigerator and 14 gauge (2.0) stainless steel top.
6. All insulation shall be fully encased or enclosed.

F. Joint Materials
   1. Sealants: 1-part or 2-part, polyurethane or silicone based, liquid elastomeric sealant, non-solvent release type, Shore A hardness of 30, except 45 if subject to traffic. Sealants shall be NSF Listed for use in food zones. Installation shall comply with applicable requirements of NSF Standards.
   2. Backer Rod: 3/8 inch or larger joints shall be polyurethane rod stock, larger than joint width.
   3. Gaskets: Solid or hollow (but not cellular) neoprene or polyvinyl chloride, light grey, minimum of 40 Shore A hardness, self-adhesive or prepared for either adhesive application or mechanical anchorage.

G. Paint and Coatings
   1. Provide the types of painting and coating materials which, after drying or curing, are suitable for use in conjunction with food service, durable, non-toxic, non-dusting, non-flaking, mildew resistant, and comply with governing regulations for food service.
   2. Galvanize Repair Paint: MIL-P-21035.
   3. Sound Deadener: NSF listed sound deaden material such as latex sound deadener for internal surfaces of metal work and underside of metal counters and tables between work top and underbracing.
   4. Pretreatment: SSPC-PT2 or PT3, of FS TT-C490.
   5. Primer Coating for Metal: FS TT-P-86, type suitable for baking, where indicated.
   6. Enamel for Metal: Synthetic type, FA TT-P-491, type suitable for baking, where indicated.

2.03 FABRICATED PRODUCTS

A. Hardware
   1. General: Manufacturer's standard, but not less than ANSI 156.9 Type 2 (Institutional), satin finish stainless steel or dull chrome finish on brass, bronze, or steel.
   2. Hinged Door Hardware: Hinged doors shall be mounted with heavy duty NSF approved hinges with Component Hardware Group, Model No. P62-1010 pulls, or equal. Catches shall be heavy-duty magnetic type, except as otherwise indicated.
   3. Drawer Hardware: Slides to be 200 pounds minimum capacity per pair, 300 series stainless steel, full extension, side-mounting, self-closing type, with stainless steel ball bearings and positive stops, Component Hardware Group Series S52, or equal. Pulls shall be Component Hardware Group, Model No. P62-1 012, or equal.
   4. Sliding Door Hardware: Sliding doors shall be mounted on large, quiet ball bearing rollers in 14-gauge (2.0mm) stainless steel overhead tracks and be removable without the use of tools. Bottom of cabinet shall have stainless steel guide-pins and not channel tracks for doors.
   5. All hardware shall be identified with manufacturer's name and number so that broken or worn parts may be replaced.

B. Casters
   1. Type and size as recommended by caster manufacturer, NSF approved for the type and weight of equipment supported, but not less than 5 inch (127mm) diameter heavy-duty, ball bearing, solid or disc wheel with non-marking grease proof rubber, neoprene or polyurethane tire, unless otherwise specified. Minimum width of tread shall be 1-3/16 inch (30mm). Minimum capacity per caster shall be 250 pounds (113.4kg), unless otherwise noted in itemized specifications.
   2. Provide solid material wheels with stainless steel rotating wheel guard.
   3. To be sanitary, provide sealed wheel and swivel bearings and polished plated finish per NSF.
   4. Unless otherwise indicated, equip each item with two (2) swivel-type casters and two (2) fixed casters. Provide foot brakes on two (2) casters on opposite front corners of equipment.
   5. Unless equipment item is equipped with another form of all-around protective bumper, provide circular rotating bumper above each caster, 5 inch (127mm) diameter tire of light grey synthetic rubber (hollow or closed-cell) on cadmium-plated disc.

C. Plumbing Fittings, Trim and Accessories
   1. General: Where exposed or semi-exposed, provide bright chrome plated brass or polished stainless steel units. Provide copper or brass where not exposed.
   2. Vacuum Breakers: Provide with food service equipment as listed in the itemized specifications.
   3. Water Outlets: At sinks and at other locations where water is supplied (by manual, automatic or remote control), furnish commercial quality faucets, valves, dispensers or fill devices of the type and size indicated and as required to operate as indicated.
   4. Waste Fittings: Except as otherwise indicated, furnish 2 inch (50mm) remote-lever waste valve and 3-1/2 inch (89mm) strainer basket.

D. Electrical Materials
   1. General: Provide standard materials, devices and components as recommended by the manufacturer or fabricator, selected and installed in accordance with NEMA standards and recommendations and as required for safe and efficient use and operation of the food service equipment without objectionable noise, vibration and sanitation problems.
   2. Before ordering equipment, confirm pertinent electrical requirements with the serving electrical utility, such as actual voltages available, number of phases and number of wires in the system.
   3. Wire electrical work for fabricated equipment completely to a junction or pull box which is wholly accessible and mounted on the equipment. Wiring shall be labeled for outlet or item served. Verify local requirements for UL Listing on complete assembly and provide if required.
   4. Components shall bear the UL label or be approved by the prevailing authority.
   5. Provide Custom fabricated refrigerator units with vapor tight light receptacles, shatterproof lamps and automatic switches. Conceal wiring.
   6. Controls and Signals: Provide recognized commercial grade signals, on-off push buttons or switches, and other speed and temperature controls as required for operation, complete with pilot lights and permanent signs and graphics to assist the user of each item. Provide stainless steel cover plates at control and signal electrical boxes. Locate controls and switches out of heat zones, in easily accessible locations that preclude accidental contact by employees.
   7. Internal Wiring of Fixtures and Equipment
      a. The Contractor shall be responsible for internal wiring of electrical devices built into or forming an integral part of fabricated equipment items. Wiring will be in metal conduit, connected to an accessible pull-box or j-box, and tagged for intended use. Refer to Section 26 Specifications for color coding of wiring.
      b. Each standard item shipped in sections shall be properly connected internally and verified by the Contractor.
      c. Furnish dish washers and conveyors internally wired to junction box or distribution panel as specified, including push button switches, motors, immersion heaters, solenoids, etc.
      d. Where light fixtures are specified or detailed as part of counters, furnish and install cases or fixtures, light fixtures, lamps and shields. Provide warm white lamps unless otherwise specified. If fluorescent light fixtures are specified, provide ballasts and include shields. Provide shields for all light fixtures.
      e. Wiring for built-in strip heaters or immersion-type elements shall be provided as follows:
         a) In heat zone: shall have UL approved insulation and be not less than 300-volt rated heat resistant insulation with nickel wire.
         b) Connection wiring extended in raceway or conduit to junction or pull box shall be not less than 600 volt rated heat resistant insulation covered wire, UL approved, or equal.
      f. Wiring for fabricated refrigerator and freezer cabinets shall be UL approved insulated cable from exterior junction box to internal components, within insulation unless code requires metallic conduit:

c) Conduit shall be Electrical Metallic Tubing, rigid or flexible (Greenfield). For freezer applications, Seal-Tite Flex or approved equal shall be used.
d) Internal wiring shall be UL approved rubber covered 600 volt rated conductor, except door heaters, which shall be Nichrome wire with silicone braided jacket, having resistance of 10.4 watts per lineal foot.
e) Mount convenience outlets, lighting receptacles, (rubber or porcelain) and door switches in approved boxes. Convenience outlets for evaporators shall be twist lock type. Solid connections, as for freezer evaporators, shall be made vapor tight.

g. Exposed flexible steel conduit on kitchen equipment shall be neoprene jacketed Seal-Tite conduit equal to Anaconda type "UA". UL approved, complete with approved liquid tight connectors on each end, and designed to provide electrical grounding continuity.
h. Exposed electrical conduit used in kitchen wet area applications, except for flexible connections, shall be rigid galvanized steel. Thin wall conduit (EMT) shall not be permitted for wet areas. Exposed outlet boxes shall be liquid tight type, with threaded hubs.

8. Convenience and Power Outlets
   a. Make cutouts and install appropriate boxes or outlets in fabricated fixtures, complete with wiring, conduit, outlet and stainless steel cover plate.
   b. Outlets and plugs shall conform to NEMA standards.
   c. Electrical outlets and devices shall be first quality "Specification Grade".
   d. Furnish GFCI outlets where adjacent to sink compartments, as per the National Electrical Code.
9. Plugs and Cords: Where cords and plugs are provided, they shall comply with National Electrical Manufacturer's Association (NEMA) requirements. Indicate NEMA configuration for each applicable item.
10. Heating Equipment
    a. Install electric and heating equipment as to be readily cleanable or removable for cleaning.
    b. Steam heated custom fabricated equipment shall be a self-contained assembly, complete with control valves located in an accessible position.
11. Motors: Totally enclosed type, except drip-proof type where not exposed to a dust or moisture condition; ball bearings, except sleeve bearings on small timing motors; windings impregnated to resist moisture; horse-power and duty-cycle ratings as required for the service indicated.
12. Power Characteristics: Refer to Division 26 specifications for project power characteristics. Also, refer to individual equipment requirements, for loads and ratings.

2.04 FABRICATION OF METAL WORK

A. General Fabrication Requirements
   1. Remove burrs from sheared edges of metalwork, ease the corners and smooth to eliminate cutting hazard. Bend sheets of metal at not less than the minimum radius required to avoid grain separation in the metal. Maintain flat, smooth surfaces without damage to finish.
   2. Reinforce metal at locations of hardware, anchorages, and accessory attachments wherever metal is less than 14 gauge (2.0mm) or requires mortised application. Conceal reinforcements to the greatest extent possible. Weld in place, on concealed faces.
   3. Exposed screws or bolt heads, rivets, and butt joints made by riveting straps under seams and then filled with solder will not be accepted. Where fasteners are permitted, provide Phillips head, flat or oval head machine screws. Cap threads with acorn nuts, unless fully concealed in inaccessible construction, and provide nuts and lock washers unless metal for tapping is at least 12 gauge (2.5mm). Match fastener head finish with finish of metal fastened.

4. Where components of fabricated metal work are indicated to be galvanized and involve welding or machining of metal heavier than 16 gauge (1.6mm), complete the fabrication and provide hot-dip galvanizing of each component, after fabrication, to the greatest extent possible (depending upon available dip-tank sizes). Comply with ASTM A123.
5. Welding and Soldering
    a. Materials 18-gauge (1.27mm), or heavier, shall be welded.
    b. Seams and joints shall be shop welded or soldered as the nature of the material may require.
    c. Welds must be ground smooth and polished to match original finish.
    d. Where galvanizing has been burned off, clean and touch up the weld with high grade aluminum paint.
6. Provide removable panels for access to mechanical and electrical service connections, which are concealed behind or within food service equipment, but only where access is not possible and not indicated through other work.
7. Closures: Where ends of fixtures, splash backs, shelves, etc., are open, fill by forming the metal or welding sections, if necessary, to close entire opening flush to walls or adjoining fixtures.
8. Rolled Edges: Rolled edges shall be as detailed, with corners bull nose, ground and polished.
9. Coved Corners: Stainless steel food service equipment shall have 1/2 inch (13mm) or larger radius coves in horizontal and vertical corners, and intersections, per NSF standards.

B. Metal and Gauges
1. Except as otherwise indicated, fabricate exposed metalwork from stainless steel. Fabricate the following components from the gauge of metal indicated and other components from not less than 20 gauge (0.8mm) metal:
    a. Table and counter tops: 14 gauge.
    b. Sinks and drain boards: 14 gauge.
    c. Shelves: 16 gauge.
    d. Front drawer and door panels: 18 gauge (double pan construction).
    e. Single pan doors and drawer fronts: 16 gauge.
    f. Enclosed base cabinets: 18 gauge.
    g. Enclosed wall cabinets: 18 gauge.
    h. Exhaust hoods and ventilators: 18 gauge.
    i. Pan-type insets and trays: 16 gauge.
    j. Removable covers and panels: 18 gauge.
    k. Skirts and enclosure panels: 18 gauge.
    l. Closure and trim strips over 4" wide: 18 gauge.
    m. Hardware reinforcement: 12 gauge.
    n. Gusset plates: 10 gauge.
    o. Custom channel bases: 14 gauge.

C. Work-Surface Fabrication
1. Fabricate metal work surfaces by forming and welding to provide seamless construction using welding rods matching sheet metal, grinding and polishing. Where necessary for disassembly, provide waterproof gasketed draw-type joints with concealed bolting.
2. Reinforce work surfaces 30 inches on center both ways with galvanized or stainless steel concealed structural members. Reinforce edges, which are not self-reinforced, by formed edges.

D. Metal Top Construction
1. Metal tops shall be one-piece welded construction, including field joints. Secure to a full perimeter galvanized steel channel frame cross-braced not farther than 2'-6" (760mm) on center. Fasten top with stud bolts or tack welds. If hat sections are used in lieu of channels, close ends.

2. Use properly designed draw fastening, trim strip, or commercial joint material to suit requirement, only if specified.

E. Structural Framing
   1. Except as otherwise indicated, provide framing of minimum 1 inch (25mm) pipe-size round pipe or tube members with mitered and welded joints and gusset plates ground smooth. Provide 14 gauge (2.0mm) stainless steel tube for exposed framing, and galvanized steel pipe for concealed framing.
   2. Where indicated, flange rear and end edges up to form splashes integrally with top, with vertical and horizontal corners coved of not less than 1/4 inch (6mm) radius, die formed. Turn back splashes 1 inch to wall across top and ends with rounded edge on break, unless otherwise specified.
   3. For die-crimped edges, use inverted "V" 1/2 inch (13mm) deep inside and 2 inch (38mm) deep on outside, unless otherwise shown. For straight down flanges, make 1- 3/4 inch (45mm) deep on outside. For bull nose edges, roll down 1-3/4 inch (45mm).
   4. Edges: die-formed, integral with top. For rounded corners, form to 1 inch radius, weld, and polish to original finish.

F. Field Joints: For any field joint required because of size of fixture, use butt-joints, reinforce on underside with angles of same material, bolt together with non-corrosive bolts and nuts, field weld, grind and polish.

G. Pipe Bases: Construct pipe bases of 1-5/8 inch (41mm) diameter 18 gauge (1.2mm) stainless steel tubing. Fit legs with polished stainless steel sanitary adjustable bullet feet to provide for adjustment of approximately 1-1/2 inch (38mm), without exposing threads. Space legs to provide ample support for tops, precluding any possibility of buckling or sagging and in no case more than 6'-0" centers.

H. Legs and Cross-rails
   1. Equipment legs and cross rails shall be 1-5/8 inch (41mm), 16-gauge (1.59mm) stainless steel tubing.
   2. Welds at cross rails shall be continuous and ground smooth. Please note: tack welds are not acceptable.
   3. Camber bottom of legs inward and fit with a stainless steel bullet-type foot with not less than 2 inch (50mm) adjustment. Flanged feet with bolt holes may be required dependent on design applications. Provide proper type feet in compliance with local codes. Use stainless steel in all applications.
   4. Peg free standing legs to floor with 1/4 inch (6mm) stainless steel rod.
   5. Components
      a. Stainless Steel Gusset: Stainless steel exterior to fit 1-5/8 inch (41mm) tubing, with Allen screw for fastening and adjustment. Not less than 3 inches (76mm) diameter at top and 3-3/4 inch (95mm) long. Outer shell 16-gauge (1.6mm) stainless steel, reinforced with 12-gauge (2.5mm) mild steel insert welded interior shell, or approved equal.
      b. Stainless Steel Low Counter Legs: Stainless steel exterior 5-3/4 inch (146mm) minimum, 7 inch (178mm) maximum length with stainless steel 3- 1/2 inch (89mm) square plate with four counter-sunk holes, welded to top for fastening.
      c. Stainless Steel Adjustable Foot: Stainless steel 1-1/2 inch (38mm) diameter tapered at bottom to 1 inch (25mm) diameter, fitted with threaded cold rolled rod for minimum 1-1/2 inch (38mm) diameter x 3/4 inch (19mm) threaded bushing plug welded to legs, or approved equal. Push-in foot not acceptable.
   6. Fasten legs to equipment with gussets, as follows:
      a. Sinks: Reinforced with bushings and set screw.
      b. Metal Top Tables and Dish Tables: Welded to galvanized steel channels, 14- gauge (1.98mm) or heavier, anchored to top with screws through slotted holes.
      c. Wood Top Tables: Welded to stainless steel channels, 14-gauge (1.98mm) or heavier, anchored to top with screws through slotted holes.

I. Shelves
   1. Construct solid shelves under pipe base tables of 16 gauge stainless steel, with 1-1/2 inch turned down and under edges on exposed sides, and 2 inch turn up against walls or equipment. Fully weld to pipe legs.
   2. In fixtures with enclosed bases, turn up shelves on back and sides with 1/4 inch (6mm) (minimum) radius and feather slightly to ensure a tight fit to enclosure panels.

J. Sinks
   1. Construct sinks of 14 gauge stainless steel with No.4 finish inside and outside.
   2. Form back, bottom and front of one piece, with ends and partitions welded into place. Partitions: double thickness, 1 inch minimum space between walls. Multiple compartments shall be continuous on the exterior, without applied facing strips or panels.
   3. Cove interior vertical and horizontal corners of each tub not less than 1/4 inch radius, die formed. Outer ends of drain boards to have roll rim risers not less than 3 inches high.
   4. Drill faucet holes in splashes 2-1/2 inches below top edge. Verify center spacing with faucet specified.
   5. Sink insets shall be deep drawn of 16-gauge (1.59mm), or heavier, polished stainless steel. Weld into sink drain boards with 1-1/2 inch x 1-1/2 inch x 14 gauge stainless steel angle brackets, securely welded to sinks and galvanized cross angles spot welded to underside of drain boards to form an integral part of the installation.
   6. The bottom of each compartment shall be creased such as to ensure complete drainage to waste opening. Slope bottom of sink bowls toward outlet.

K. Drains, Wastes and Faucets
   1. Furnish and install T&S Brass faucets model B-3940-01 stainless steel rotary drain assembly with connected overflow assembly, in die-drawn inset type sinks and bain-marie sinks.
   2. Other custom fabricated sinks shall be furnished with T&S Brass faucets model B3940-01 stainless steel rotary drain assembly, with S/S cap nut over overflow outlet. Waste connection shall have 2 inch (50mm) external thread size, with 1-1/2 inch (38mm) internal thread size.
   3. Rotary Handle: Of sufficient length to extend to front edge of sink. No riveting, screws or soldering permitted to fit drains to sinks, with all parts of drains easily removable for servicing and replacement. Rotary handle bracket to be provided as part of the sink fabrication.
   4. Water pans for steam tables shall be fitted with 1 inch (25mm) drains with chrome-plated brass stand pipes.
   5. All faucets furnished with equipment included in this Section shall be lead-free and comply with NSF Standard #61, Section #9, such as manufactured by Fisher, Chicago, or T&S. Where the itemized specifications list a faucet by manufacturer and model, the Contractor shall verify that the listed faucet complies with this requirement.
   6. If the listed faucet does not comply, the Contractor shall submit similar model which does comply from the same manufacturer where available or from one of the above manufacturers.

L. Workmanship
   1. Best quality in the trade. Field verify dimensions before fabricating, conform all items to dimensions of building, neatly fit around pipes, offsets and other obstructions.
   2. Fabricate only in accordance with approved shop drawings, showing pipes, obstructions to be built around, and location of utilities and services.

M. Enclosures
   1. Provide enclosures, including panels, housings, and skirts for service lines, operating components and mechanical and electrical devices associated with the food service equipment, except as specifically indicated to be "open".
   2. Where equipment is exposed to customer view, enclose of service lines, operating components, and mechanical and electrical devices.

N. Casework
   1. Enclosure: except as otherwise indicated, provide each unit of casework (base, wall, overhead and free-standing) with a complete-enclosure metal cabinet, including fronts, backs, tops, bottoms, and sides.
   2. Bases shall be made of 18-gauge (1.27mm) stainless steel sheets reinforced by forming the metal.
   3. Ends, partitions and shelves are stainless steel.
   4. Unexposed backs and structural members are galvanized.
   5. Vertical ends and partitions are single wall, with a 2 inch (50mm) face.
   6. Sides and through partitions are flush with bottom rail, welded at intersections.
   7. Shelves: Provide adjustable standards for positioning and support of shelves in casework, except bottom shelf of cabinet mounted on legs or as specified. Turn back of shelf units up 2 inches and hem. Turn other edges down to form open channel. Reinforce shelf units to support 40 pounds per square foot loading, plus 100 percent impact loading.
   8. Bottom front rail of bases set on masonry platform shall be continuously closed and sealed to platform.

O. Doors
   1. Metal doors shall be double-cased stainless steel. Outer pans shall be 18-gauge (1.27mm) stainless steel with corners welded, ground smooth and polished. Inner pan shall be 20-gauge (.95mm) stainless steel fitted tightly into outer pan with a sound-deadening material such as Celotex or Styrofoam used as a core. The two pans shall be tack welded together and joints solder filled. Doors shall finish approximately 3/4 inch (19mm) thick and be fitted with flush recessed type stainless steel door pulls.
   2. Wood doors shall be fabricated as detailed. If Formica or other plastic surfaces are used, sides and backs must be laminated.
   3. Hinged doors shall be mounted on heavy-duty NSF approved hinges, or as noted on plans or specifications.

P. Drawer Assemblies
   1. Assemblies shall consist of removable drawer body mounted in a ball bearing slide assembly with fully enclosed housing.
   2. Slide assembly consists of one pair of 200 pound stainless steel roller bearing extension slides, with side and back enclosure panels, front spacer angle, two drawer carrier angles secured to slides and stainless steel front.
   3. Drawer bodies for general storage are to be 20 inches x 20 inches (508mm x 508mm), with 18 gauge stainless steel containers.
   4. Drawers intended to hold food products shall be removable type with 12 x 20 (305mm x 508mm) stainless steel food pans in a stainless steel assembly.
   5. Drawer fronts are double cased, 3/4 inch (19mm) thick with 18 gauge (1.27mm) stainless steel welded and polished front pan. Steel back pan is tightly fitted and tack welded. Sound deaden with rigid insulation material.
   6. Provide drawers with replaceable soft neoprene bumpers or for refrigerated drawers, a full perimeter soft gasket.

Q. Closed Base: Where casework is indicated to be located on a raised-floor base, prepare casework for support without legs and for anchorage and sealant application, as required for a completely enclosed and concealed base.

R. Support from Floor: Equip floor supported mobile units with casters and equip items indicated as roll-out units with manufacturer's standard one-directional rollers. Otherwise, and except for closed-base units, provide pipe or tube legs with adjustable bullet-design feet for floor supported items of fabricated metalwork. Provide 1-1/2 inch adjustment of feet (concealed threading).

S. Shop Painting
   1. Clean and prepare metal surfaces to be painted. Remove rust and dirt. Apply treatment to zinc coated surfaces which have not been mill phosphatized. Coat welded and abraded areas of zinc coated surfaces with galvanize repair paint.
   2. Apply 1.5 mil (dry film thickness) metal primer coating, followed by 2, 1.0 mil (dry film thickness) metal enamel finish coatings.
   3. Bake primer and finish coatings in accordance with paint manufacturer's instructions for a baked enamel finish.

T. Sound Deadening
   1. Sound deaden underside of metal tops, drain boards, under shelves, cabinet interior shelves, etc., above the underbracing/reinforcing/framing only.

2.05 FILTER EXHAUST HOODS, WATER WASH VENTILATOR FABRICATION AND ULTRAVIOLET

A. Filter Exhaust Hoods
   1. 18 Gauge type 304 stainless steel external welded construction, in accordance with the latest edition of NFPA No.96, including all applicable appendices. Exposed welds to be ground and polished.
   2. Grease Removal: UL classified, non-adjustable, stainless steel grease filters with drip-channel gutters, drains and collection basins.
   3. Light Fixtures: Furnish type of fixture specified. Fixtures shall be UL listed for hoods, NSF approved, with sealed safety lenses and stainless steel exposed conduit for wiring.
   4. Exhaust Duct: Furnish welded stainless steel formed duct collars at ceiling or wall duct connections, where exposed. Furnish exposed to view ductwork as specified. Verify size and location of duct connections required in this contract, before fabrication. Other ductwork will be by the Mechanical Section.
   5. Fire Extinguishing System: Pre-piped liquid chemical or water fire suppressant system, as specified, complying with applicable local and NFPA regulations. Wet chemical fire suppression systems shall comply with UL 300 Standards.

B. Water Wash Ventilator
   1. 18 Gauge type 304 stainless steel external welded construction, in accordance with the latest edition of NFPA No.96, including all applicable appendices. Exposed welds to be ground and polished.
   2. Control panel shall be of same manufacture as ventilator, with time clock control for automatic operation. Provide stainless steel trim strips for recessed control cabinet applications. Provide stainless steel chase for surface mounted control panel from top of panel to ceiling, full width and depth of panel.
   3. Light Fixtures: Furnish type of fixture specified. Fixtures shall be UL listed for hoods, NSF approved, with sealed safety lenses, with stainless steel exposed conduit for wiring.
   4. Exhaust Duct: 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. Other ductwork will be by the Mechanical Section.
   5. Fire Extinguishing System: Pre-piped liquid chemical or water fire suppressant system, as specified, complying with applicable local and NFPA regulations. Wet chemical fire suppression systems shall comply with UL 300 Standards.

C. Ultra-Violet Component Grease Elimination Hood
   1. If applicable for this project, refer to Hood Manufacture’s Drawings in the Food Service Design Issue of Construction Set, FS-8 sequence.

2.06 REFRIGERATION EQUIPMENT

A. General
   1. Furnish either single or multiple compressor units, as specified or recommended by the manufacturer for the sizes and variations between connected evaporator loads as indicated.

2. Furnish units of the capacities indicated, arranged to respond to multiple-evaporator thermostats and defrosting timers. Include coils, receivers, compressors, motors, motor starters, mounting bases, vibration isolation units, fans, dryers, valves, piping, insulation, gauges, winter control equipment and complete automatic control system.
3. Refrigerant: Pre-charge units with type or types recommended by manufacturer for services indicated, with quick-disconnect type connections where specified, ready to receive refrigerant piping runs to evaporators and (where remote) to condensers. All refrigerant and associated components shall comply with the requirements of the Montreal Protocol Agreement. No CFC refrigerants or associated components shall be allowed on this Project. HFC refrigerants and components shall be used where available. HCFC refrigerants and components, with a minimum 2010 phase-out date, and intermediate replacement refrigerants are to be used only when HFC refrigerants are not available. Contractor shall be responsible for coordinating with manufacturers. Provide refrigerant leak monitoring devices where required by federal, state, or local codes.
4. The minimum outdoor operating ambient temperature for design of units is -10 degrees Fahrenheit, or as applicable for extreme low local conditions. The maximum indoor design temperature for operation of compressor units is 95 degrees Fahrenheit. The maximum outdoor ambient design temperature shall be determined with prevailing conditions at mounting location(s) of compressor(s), such as sun exposure, limited ventilation, high fences/walls, roof color and materials, local climatic extremes, etc., but in no case shall it be less than 100 degrees Fahrenheit.

B. Components
1. Coils: Coils for fabricated refrigerators shall have vinyl plastic coatings, stainless steel housings and shall be installed in such a manner as to be replaceable.
2. Expansion Valves: Remote refrigeration system shall be complete with thermostatic expansion valves at the evaporator.
3. Thermometers
   a. Fabricated refrigerated compartments to be fitted minimally with a flush dial thermometer, with chrome plated bezels and to be provided as specified.
   b. Thermometers shall be adjustable and shall be calibrated after installation.
   c. Thermometers shall have an accuracy of ± 2 degrees Fahrenheit (1 degree Centigrade).
4. Hardware
   a. Refrigerator hardware for fabricated refrigerator compartments shall be heavy-duty components.
   b. Self-closing hinges.
   c. Latches to be magnetic edge mount type, unless specified or detailed otherwise.
5. Locks
   a. Doors and drawers for walk-in coolers/freezers and reach-in refrigerated compartments, both fabricated and standard, shall be fitted with cylinder locking type latches and provided with master keys.

C. Cold Pans: Ice pans, refrigerated pans and cabinets shall be provided with breaker strips, where adjoining top or cabinet face materials, to prevent transfer of cold.

D. All open top mechanically cooled custom fabricated or standard buy-out refrigerators and/or cold pans shall comply with NSF Standard #7 requirements, as of April 1, 1998. The Contractor shall verify that the specified unit complies with this requirement or submit a similar model, which does comply, from the same manufacturer where available.

E. Ventilation of Refrigerated Equipment
1. Adequate ventilation shall be provided for custom fabricated equipment with integral refrigeration condensing units, both built-in and drop-in. If flow through ventilation cannot be provided, provide flow direction partitions and an additional fan capable of cooling the condensing unit.

2. If, in the opinion of the Contractor, additional room ventilation is required to ensure correct operating temperatures of standard buy-out, custom fabricated or remote refrigeration condensing units, or compressor rack assemblies, they shall so state in a letter to the Architect for evaluation and direction.

2.07 MISCELLANEOUS MATERIALS

A. Nameplates: Whenever possible, locate nameplates and labels on manufactured items, in accessible position, but not within customer's normal view. Do not apply name-plates or labels on custom fabricated work, except as required for compliance with governing regulations, insurance requirements, or operator performance.

B. Manufactured Equipment Items: Furnish items as scheduled or herein specified. Verify dimensions, spaces, rough-in and service requirements, and electrical characteristics before ordering. Provide trim, accessories and miscellaneous items for complete installation.

C. Insert Pans
   1. General: Provide cut-outs, openings, drawers, or equipment specified or detailed to hold stainless steel insert pans with a full complement of pans as follows:
      a. One (1) stainless steel, 20-gauge (.95mm) minimum, solid insert pan for each space, sized per plans, details, or specifications.
      b. Where pan sizes are not indicated in plans, details, or specifications, provide one full-size pan for each opening.
      c. Provide maximum depth pan to suit application and space.
   2. Provide 18-gauge (1.27mm) removable stainless steel adapter bars where applicable.
   3. Provide all cut-outs and openings or equipment specified or detailed to hold stainless steel insert pans with a hinged stainless steel removable night cover.

D. Tray Slides: Before fabrication of counters with tray slides, verify:
   1. Size and shape of tray. Edge of tray shall not overhang outer support/slider by more than 2". If edge of tray exceeds this dimension, notify Architect, in writing, for evaluation and adjustment, if necessary.
   2. Configuration of corners, turns, and shape of tray slides for proper support and safe guidance of trays.
   3. Tray slide capable of supporting 200 pounds per linear foot, live load.

E. Self-leveling dispensers: Verify type and make of ware, dimensions and weight, request samples from Operator and submit to the dispenser manufacturer for proper sizing and calibration of dispensers.

F. Carbon dioxide (co') equipment: Where equipment requires connection with compressed co' cylinder for operation, provide proper sized cylinder manifold and control system (integral with equipment) with proper connectors for Department of Transportation (DOT) approved type cylinders, complete with cylinder safety devices and supports.

G. Reasonable quietness of operation of equipment is a requirement. The Kitchen Equipment Contractor will be required to replace or repair any equipment producing out-of-the-ordinary intolerable noise. This also includes providing and installing bumpers and gaskets for doors and drawers on fabricated and standard manufactured items and sound insulation where feasible.

2.08 ITEMIZED SPECIFICATIONS

A. Refer to the following pages for specific specification information on each item included in this Section.

ITEM 1 AIR CURTAIN: 1 REQUIRED

A. Berner, one model SLC07-1048A-SS *H011 with micro plunger switch.

ITEM 2 MOP SINK CABINET: 1 REQUIRED

A. Advance Tabco, model 9-OPC-84DL-300 *H011 left side with the following accessories:
   1. Model SU-27 door lock.
   2. K-94-SHELF fixed mid-shelf.

3. Model K-94-BACK-300 stainless steel back panel.
4. Model K-472 service faucet holes; verify height.
5. Model K-240 service faucet.
6. 18-gauge type "304" stainless steel cabinet.

B. Install assembly complete.

ITEM 3 STAFF LOCKERS (HALF SIZE): 6 REQUIRED

A. Specified by Architectural Division.

ITEM 4 WALK-IN COLD STORAGE ROOMS: 2 REQUIRED

A. Imperial Brown Manufacturing, modular sandwich panel design Foam-A-Lite *H011 cold storage rooms complete in configuration shown on Sheet FS101. Rooms shall incorporate the following:
1. Provide G3 flush self-closing cooler and freezer walk-in doors and door frames 36 inch x 78 inch stainless steel inside and out with 14 inch x 14 inch insulated glass window (heated for freezer) and 36” high 1/8” polished aluminum diamond tread plate interior and exterior kick plates. Doors hinged as shown on plan. Include Kason #944K rem-core deadbolt mortise locksets with interior safety releases, Kason #1229 chrome pull handles, Kason #1094000013 concealed mounting door closers, and Keil W59 adjustable hinges (three per door).
2. Provide 36” high 1/8” polished aluminum diamond tread plate wainscot on exposed exterior face of walk-in cold storage rooms.
3. Exposed exterior, closure panels, and trim strips to adjacent walls and ceiling shall be 22 gauge stainless steel finish. Exposed interior shall be .040 stucco embossed aluminum except ceiling which shall be .040 aluminum with baked white acrylic finish. Unexposed surfaces shall be 26 gauge galvanized steel.
4. Finished exterior height of 8 foot-4 inches. Interior height of rooms shall be 8 foot-0 inches. Wall and ceiling insulation shall be 4 inch thick foamed in place, Class 1, urethane insulation.
5. Install in floor depression complete with 4” prefabricated high density urethane floor panels. Install in recess with 2.5” thick concrete topping slab by GC. See Sheet FS301 for depression details.
6. Install surface mounted 4-1/2 inch diameter dial thermometer above each door.
7. Heated vacuum vent for freezer.
8. Provide 3/8 inch diameter nylon coil hangers mounted on 3 inch x 3 inch aluminum plates with nuts and retainers to support evaporator hung from ceiling panel.
9. Furnish penetrations to accommodate all electrical, plumbing, and refrigeration lines. Furnish stainless steel escutcheons.
10. Provide Keil LED48X754-CL-N LED cooler and freezer ceiling light fixtures as noted on Sheet FS-104 (three fixtures per room). Field connections under Division 26. Include lamps.
11. Include Modularm, model 7.5LC multi-monitor temp alarm with MD1 motion sensor; mounted at door.
12. All electrical conduits shall be run concealed within the walk-in walls or above the ceiling panels (coordinate with electrician).
13. Include 6” high stainless steel cove base inside and exposed outside of each room.
14. Refer to Architectural Room Finish Schedule for cooler/freezer wearing floor material inside and out by Division 9.
15. Sealants for all walk-in panel penetrations: 1-part or 2-part, polyurethane or silicone based, liquid elastomeric sealant, non-solvent release type, Shore A hardness of 30, except 45 if subject to traffic. Sealants shall be NSF Listed for use in food zones. Installation shall comply with applicable requirements of NSF Standards.

B. Walk-ins shall comply with current state energy codes.

C. Walk-ins shall be installed by this manufacturer or this manufacturer’s certified installer only and must have a minimum 5 years’ experience installing Imperial walk-ins.

D. Walk-in doors are to be secured in the “open” position until the concrete sub-floor cures and until manufacturer states that it is safe to close. Oxidized panels will be replaced at the Contractors’ expense.

E. Walk-ins shall bear the State Seal.

ITEM 5 REFRIGERATION SYSTEMS: 2 REQUIRED

A. System A: Cooler @ +35°F to +40°F
   1. Evaporator: Trenton TPLP107MAS1DR8-ESP; 6,890 BTU at 20°F suction temperature. Include expansion valve, drier strainer, liquid line solenoid, and room thermostat.
   2. Condensing Unit: Trenton TQZA007H8-HS2D; 7,337 BTU at 90° ambient air temperature. Include crank case heater. Refrigerant will be R-448.

B. System B: Freezer @ -10°F to +0°F
   1. Evaporator: Trenton TPLP207LES2DR8-ESPE; 7,000 BTU at -10°F suction temperature. Include expansion valve, drier-strainer, liquid line solenoid, room thermostat, and electric defrost system.
   2. Condensing Unit: Trenton TQZA020L6-HT3D; 7,354 BTU at +90°F ambient air temperature. Include crank case heater. Refrigerant will be R-448.

C. Each system shall incorporate the following:
   1. Flexible vibration eliminator in suction line.
   2. Circuit breaker, automatic starting switch, motor protectors and pressure limit switch, all enclosed with interconnecting wire installed in a junction box ready for line connections.
   3. Liquid line dehydrator filter of ample capacity.
   4. Suction line filter of ample capacity.
   5. Thermal expansion valve for evaporator.
   6. Thermostat set to cut-in at -3°F and cut-out at -6°F for freezer. Cut-in at +38°F and cut-out at +34°F for refrigerator.
   7. Suction pressure regulator.
   8. Crank case heaters.
   9. Refrigerant Lines: Hard copper type “L” with “Silfos” brazed joints. Use refrigeration service tubing.
   10. Full charge refrigerant and oil.
   11. Condensing units are located on outside wall positioned at least 6 inches from wall and first unit 8” above ground using TQH wall mount brackets. Units to be stacked with 12” vertical clearance. Verify structural integrity of wall is sufficient to support weight of condensing units and all applied optional equipment. Verify exact location with Architectural plans.

D. Where refrigerant suction lines are trapped, use next size smaller pipe in vertical portion of the trap than that indicated to acquire sufficient gas velocity for proper oil return.

E. Provide anti-sweat pipe covering 3/4 inch Armstrong Armaflex or equivalent for suction lines from evaporator to condensing unit.

F. Provide painted 1 inch drain tubing from evaporator to nearest indirect drain as shown on Sheet FS102. Trap at outlet end.

G. Provide Raychem, model H611250 heating cable with H900 power connection to wrap all drain lines running through freezer.

H. Evaporators and condensing units as shown on the Contract Documents shall be installed under the supervision of a licensed Refrigeration Contractor subject to review by the Consultant.

I. Provide testing, charging, adjusting, operational testing, and cleaning of equipment and lines.

ITEM 6 WALK-IN COOLER SHELVING: 1 LOT REQUIRED

A. Metro, Metroseal 3 *H011 Super Adjustable Super Erecta shelving. Shelf sections shall be four tier high using individual posts with adjustable feet and top caps equally spaced over 74-5/8 inch plated posts with bottom shelf located 8 inches above finished floor. Install in sizes and configuration as shown on Sheet FS101.

B. Include one 22” x 48” HP2248PD dunnage rack.

C. Verify room size before ordering.

ITEM 7 WALK-IN FREEZER SHELVING: 1 LOT REQUIRED

A. Metro, Metroseal 3 *H011 Super Adjustable Super Erecta shelving. Shelf sections shall be four tier high using individual posts with adjustable feet and top caps equally spaced over 74-5/8 inch plated posts with bottom shelf located 8 inches above finished floor. Install in sizes and configuration as shown on Sheet FS101.

B. Include one 22” x 48” HP2248PD dunnage rack.

C. Verify room size before ordering.

ITEM 8 CORNER/CHANNEL GUARDS AND LOW WALL CAP: 1 LOT REQUIRED

A. Fabricate as detailed and construct corner/channel guards and low wall cap of one piece all welded 14 gauge stainless steel. Install in locations shown on Sheet FS101 and per elevations and details sheets. Install with stainless steel screws.

B. Seal guards to walls as required.

ITEM 9 MOBILE CAN RACK: 1 REQUIRED

A. New Age, model 97294CK *H011.

ITEM 10 DRY STORAGE SHELVING: 1 LOT REQUIRED

A. Metro, Super Adjustable Super Erecta *H011 stainless steel wire shelving. Shelf sections shall be five tier high using individual posts with adjustable feet, and top caps equally spaced over 86-5/8 inch plated posts with bottom shelf located 8 inches above finished floor. Install in sizes and configuration as shown on Sheet FS101.

B. Verify room size before ordering.

ITEM 11 SHEET PAN RACKS: 2 REQUIRED

A. Channel Manufacturing, model 401S/PB *H011 with perimeter bumper.

ITEM 12 NOT USED

ITEM 13 ELECTRIC CAN OPENER: 1 REQUIRED

A. Edlund, model 270 *H011.

ITEM 14 PREP SUPPORT WORK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model WKS-12636-A6S *H011 fully welded table with the following accessories:
   1. Two model SDAS-202006S stainless steel drawer assemblies.
   2. Model TMSC-6014 cantilever over shelf over left half of table. Install with 18” clear to table top. Trim and seal openings in back splash.

B. Install assembly complete

ITEM 15 FOOD PROCESSOR: 1 REQUIRED

A. Robot Coupe, model R-602 *H011 with 5 Disc Package.

ITEM 16 BLENDER: 1 REQUIRED

A. Vitamix Commercial, model 36019 The Quiet One *H011 with extra 48-ounce blending container.

ITEM 17 30–QUART MIXER: 1 REQUIRED

A. Hobart, model HL300 *H011 with the following accessories:
   1. Standard accessory package.
   2. Bowl dolly.

B. Install assembly complete.

ITEM 18 HAND WASHING SINKS: 2 REQUIRED

A. Advance Tabco, model 7-PS-62 *H011.

B. Seal to wall.

ITEM 19 SLIM JIMS: 2 REQUIRED

A. Rubbermaid, model FG354000 *H011. Color: light gray.

ITEM 20 MOBILE WASTE RECEPTACLES: 4 REQUIRED

A. Rubbermaid, model FG263200 *H011 with FG264043 dolly and FG263100 matching lid. Color: grey.

ITEM 21 VEGETABLE PREP SINK TABLE: 1 REQUIRED

A. Pacific Stainless Products, model DCS-1824-14-B30 *H011 fully welded Spec Line sink table. Sink table shall incorporate the following:
   1. 14” deep sinks.
   2. CHG Saniguard, model KL53-1000-AF3-BR spray rinse faucet with 10” Add-On faucet. centered between sinks. Include welded stainless steel bar rod to secure riser on each side to adjacent over shelves due to low wall condition.
   3. Three Component Group, model DSS-8000 rotary waste assemblies with 14 gauge stainless steel lever waste brackets welded to underside of sink compartments.
   4. Model TMSC-3614 cantilever shelf above each drainboard. Seal post openings in backsplash.
   5. Stainless steel under shelf below left drain board.
   6. Provide parking clearance under right drain board for Item 20 Mobile Waste Receptacle.
   7. Sound deaden underside of top and sink compartments.

B. Install assembly complete. Clip and seal to wall.

ITEM 22 UTILITY CART: 1 REQUIRED

A. Lakeside, model 243 *H011 with rotating bumpers.

ITEM 23 CUBE ICE MACHINE WITH BIN: 1 REQUIRED

A. Manitowoc, model IYT-0420A *H011. Include model B-320 ice storage bin. Water filtration specified under Item 37.

ITEM 24 MANAGER’S STATION: 1 REQUIRED

A. Owner furnished and installed.

ITEM 25 SOILED DISHTABLE WITH POTWASHING SINKS: 1 REQUIRED

A. Fabricate as detailed and construct top, back/end splashes, and pass-thru opening frame of one piece all welded 14 gauge stainless steel. Include all welded integral stainless steel sinks as shown. Reinforce underside of top with enclosed stainless steel hat sections. Sound deaden underside of top and sinks and mount on a stainless steel leg stand consisting of circular gussets, tubular legs, and adjustable bullet feet. Reinforce legs with 16 gauge stainless steel shelf and/or leg braces as shown. Dishtable shall incorporate the following:
   1. CHG Saniguard model KL54-8010-splash mount faucet at 30” long sink.
   2. CHG Saniguard, model KL53-1000-AF3-BR spray rinse faucet with 10” Add-On faucet centered between 18” long sinks. Include wall bracket.
   3. Three Component Group, model DSS-8000 rotary waste assemblies with 14 gauge stainless steel lever waste brackets welded to underside of sink compartments.
   4. Cut-out top and weld in Item 27 Waste Collector top.

5. Coordinate pass-thru opening size and coiling door tracking interface with General Contractor.

B. Install assembly complete.

C. Clip and seal to walls.

ITEM 26 HOSE REEL WITH RECESSED CONTROL CABINET: 1 REQUIRED

A. Fisher, model 29610 *H011. Include model 1801 reel rinse control box assembly.

B. Contractor is to coordinate recess in wall with General Contractor for cabinet.

C. Seal assembly to wall.

ITEM 27 WASTE COLLECTOR: 1 REQUIRED

A. Salvajor, model S914 *H011 with the following accessories:
1. Additional scrap basket.

B. Install assembly complete in Item 25 Soiled Dishtable.

ITEM 28 WAREWASHER VAPOR EXHAUST DUCTS: 2 REQUIRED

A. Fabricate two 18 gauge stainless steel steam tight exhaust ducts as detailed and connect to stainless steel vent stacks furnished with Warewasher, Item 29. Extend each duct 4 inches above finished ceiling and trim with stainless steel at ceiling penetrations. Seal all gaps at trim.

B. Exhaust fan furnished and installed under Division 23.

ITEM 29 WAREWASHER WITH BOOSTER HEATER: 1 REQUIRED

A. Hobart, model CL44EN-ADV *H011 for right to left operation with the following:
1. Extended stainless steel vent hoods with vent stack and locking type damper.
2. Higher than standard chamber.
3. Table limit switch.
4. Single point electrical connection.
5. Flanged stainless steel feet.
6. Three each 6-sheet pan and combination racks.
7. Front splash guard at exit end of machine only.

B. Install assembly complete.

ITEM 30 CLEAN DISHTABLE: 1 REQUIRED

A. Fabricate as detailed and construct top and back/end splashes of one piece all welded 14 gauge stainless steel. Reinforce underside of top with enclosed stainless steel hat sections. Sound deaden underside of top and mount on a stainless steel leg stand consisting of circular gussets, tubular legs, and adjustable bullet feet. Reinforce legs with 16 gauge stainless steel shelf and/or leg braces as shown.
1. Install table limit switch furnished with Item 29.

B. Install assembly complete.

C. Clip and seal to walls.

ITEM 31 MOBILE POT AND PAN SHELVING: 1 REQUIRED

A. Metro, model PR48VX3 *H011 modified to have top shelf with cutting board/tray drying rack and two intermediate and bottom shelves to be flat louvered with 4” high end and back shelf ledges.

ITEM 32 NOT USED

ITEM 33 NOT USED

ITEM 34 NOT USED

ITEM 35 CANOPY HOOD WITH FIRE PROTECTION SYSTEM: 1 REQUIRED

A. Gaylord, model ELX-GBD–A-DCA-66 *H011, 12’-0” long x 2’-6” high 18 gauge stainless steel canopy hood. Refer to Factory File #21-0670. The hood shall incorporate the following:

1. U.L. listed damper assembly.
2. Zero inch clearance to combustibles at top, back, and sides.
3. Flush LED light fixtures as shown on Gaylord factory drawings. Furnish and install lamps.
4. Model 150-LS light and fan on/off switch. Furnish loose for installation by Division 26.
5. Model TSC Auto-Start Controller.
6. Ansul R-102-ASEF-2T-8N Restaurant Fire Suppression System furnished and installed by Gaylord. Install in accordance with NFPA bulletin 96, including all current amendments to protect this hood including surface protection as required. All piping and conduit shall be run concealed in walls or above ceiling, except where exposure in necessary for functional reasons. Exposed piping shall be chrome plated or run in stainless steel sleeves. Include reset relays and manual remote pull station. System shall connect to mechanical gas shut-off valve furnished loose by Gaylord. All contactors are furnished by the Electrical Division for shut down of electric supply to all equipment in the event of system activation. System control cabinet shall be installed in location shown.
7. Include 18 gauge stainless steel removable closure panels and trim as required to seal hood to ceiling and walls. Verify ceiling height. Submit shop drawings prior to fabrication.
8. Install hood with 80” clearance from finished floor.

B. Exhaust and supply duct work and fans furnished and installed by Division 23.

C. Install assembly complete.

ITEM 36 STAINLESS STEEL WALL FLASHING: 1 LOT REQUIRED

A. Fabricate 20 gauge stainless steel Number 4 finish wall flashing bonded to gypsum board with heat resistant mastic beginning directly above base tile on wall and terminating 2” above bottom edge of canopy hood. Flashing shall run full length of canopy hood and right end hood width at wall return.

B. Install flashing with no exposed fasteners or screws in interlocking sections of equal lengths. Verify that surfaces are flat and smooth with a maximum variation of 1/16” in 10 feet.

C. Install assembly complete.

ITEM 37 DOUBLE-STACK COMBI-OVEN STEAMERS: 1 REQUIRED

A. Alto-Shaam, two model CTC7-20E *H011 with the following accessories:
1. Stacking hardware and seismic feet package.
2. Everpure, model EV9293-22 water filtration system with two EV969321 4FC5 Cartridges. Include two extra filter media (turn over to Owner for inventory).
3. Alto-Shaam Combitherm Factory Authorized Installation Program.
4. One extra probe per oven. Turn over to Owner for inventory.

A. Install assembly complete.

ITEM 38 OPEN BURNER COOK TOP: 1 REQUIRED

A. Garland model MST4S-E *H011. Include the following:
1. Electric spark ignition.
2. End caps at each side.
3. 10” stainless steel backguard.
4. 6” heavy-duty caster set; front casters with brakes.
5. 36" long gas quick disconnect assembly with cable restraint.
6. Rear gas connection.

B. Install assembly complete.

ITEM 39 40-GALLON TILTING SKILLET: 1 REQUIRED

A. Groen, model BPP-40GC *H011 with the following accessories:
1. Double pantry fill faucet with swing spout and mounting bracket.
2. Pan carrier, universal style.
3. Lip Strainer.
4. 36” gas quick disconnect assembly with cable restraint.

5. Flanged feet.

B. Install assembly complete.

ITEM 40 FLOOR TROUGH: 1 REQUIRED

A. IMC Teddy, model ASFT-2430-SG *H011 with stainless steel subway grate.

B. Coordinate exact location to best serve the equipment pour path and verify rough-in size prior to slab pour.

ITEM 41 NOT USED

ITEM 42 NOT USED

ITEM 43 MOBILE HOT HOLDING/PROOFING CABINETS: 2 REQUIRED

A. Metro, model C599-SFSU *H011 with perimeter bumper.

ITEM 44 4-WELL HOT/COLD FOOD SERVING STATION: 1 REQUIRED

A. Vollrath, model M37023 *H011 Signature Server utility station modified with the following accessories:
   1. Vollrath, model FC-6HC-04208-AD 4-pan drop-in hot/cold wells integrated with counter top.
   2. 34" counter top height (verify custom height with Owner before ordering).
   3. Special 30” counter width.
   4. 14 gauge stainless steel countertop.
   5. Premier Metal and Glass, model TM2N-A full length food guard with 3/8” glass and LED lights as detailed in powder coat black matte fine finish. Use counter mount narrow flanges. Seal flanges to counter top. Horizontal top glass to be 10” wide.
   6. 30” high full length 14 gauge stainless steel V-rib tray slide for customer side. Verify tray slide height with Owner before ordering.
   7. 98850 Work surface flange modified with line-up locks; keyhole slots on diagonal corners with stainless slide attached to side of base.
   8. SS4Casters 4-Series Signature Server swivel casters; two with brakes.
   9. Black laminate base panels. Verify with Architect before ordering.
   10. This unit to have master daisy-chain cord set to provide power to this counter and Items 45 and 46.

B. Provide submittals for review.

C. Install assembly complete.

ITEM 45 FLAT TOP SERVING STATION: 1 REQUIRED

A. Vollrath, model M37020 *H011 Signature Server utility station modified with the following accessories:
   1. 34" counter top height (verify custom height with Owner before ordering).
   2. Special 30” counter width.
   3. 14 gauge stainless steel countertop.
   4. Premier Metal and Glass, model TM2N-A full length food guard with 3/8” glass and LED lights as detailed in black matte fine finish. Use counter mount narrow flanges. Seal flanges to counter top. Horizontal top glass to be 10” wide.
   5. 30” high full length 14 gauge stainless steel V-rib tray slides for customer side. Verify tray slide height with Owner before ordering.
   6. 98850 Work surface flange modified with line-up locks; keyhole slots on diagonal corners with stainless slide attached to side of base.
   7. SS4Casters 4-Series Signature Server swivel casters; two with brakes.
   8. Black laminate base panels. Verify with Architect before ordering.
   9. This unit to be daisy chained with Items 44 and 46.

B. Provide submittals for review.

C. Install assembly complete.

ITEM 46 2-WELL HOT/COLD FOOD SERVING STATION: 1 REQUIRED

A. Vollrath, model 37021*H011 Signature Server utility station with the following accessories:
   1. Vollrath, model FC-6HC-02208-AD 2-pan drop-in hot/cold wells integrated with counter top.
   2. 34" counter top height (verify custom height with Owner before ordering).
   3. Special 30” counter width.
   4. 14 gauge stainless steel countertop.
   5. Premier Metal and Glass, model TM2N-A full length food guard with 3/8” glass and LED lights as detailed in black matte fine finish. Use counter mount narrow flanges. Seal flanges to counter top. Horizontal top glass to be 10” wide.
   6. 30” high full length 14 gauge stainless steel V-rib tray slide for customer side. Verify tray slide height with Owner before ordering.
   7. 98850 Work surface flange modified with line-up locks; keyhole slots on diagonal corners with stainless slide attached to side of base.
   8. SS4Casters 4-Series Signature Server swivel casters; two with brakes.
   9. Black laminate base panels. Verify with Architect before ordering.
   10. This unit to be daisy chained with Items 44 and 45.

B. Provide submittals for review.

C. Install assembly complete.

ITEM 47 PORTABLE TRAFFIC CONTROL RAILINGS: 1 LOT REQUIRED

A. Tensator, TensaBarrier system, model 889T2B *H011 double tape system with Basics Base and modular cassette in black wrinkle finish.

B. Refer to Sheet FS101 for layout and configuration.

C. Verify tape color with Architect.

ITEM 48 MOBILE DOUBLE-SIDED MILK COOLER: 1 REQUIRED

A. True, model TMC-49-S-DS-SS-HC *H011 with perimeter bumper.

ITEM 49 MOBILE DOUBLE-SIDED REFRIGERATED FRUIT/VEGIE BAR: 1 REQUIRED

A. Vollrath, model 37065 *H011 Signature Server cold food station with the following accessories:
   1. 32" counter top height (verify custom height with Owner before ordering).
   2. 14 gauge stainless steel countertop.
   3. Premier Metal and Glass, model TMIR-A full length double-sided food guard with 3/8” glass and LED lights as detailed in black matte fine finish. Use counter mount narrow flanges. Seal flanges to counter top.
   4. 30” high full length 14 gauge stainless steel V-rib tray slides for customer and operator sides. Verify tray slide height with Owner before ordering.
   5. 98850 Work surface flange modified with line-up locks; keyhole slots on diagonal corners with stainless slide attached to side of base.
   6. SS4Casters 4-Series Signature Server swivel casters; two with brakes.
   7. Black laminate base panels. Verify with Architect before ordering.

B. Provide submittals for review.

C. Install assembly complete.

ITEM 50 MOBILE DOUBLE-SIDED REFRIGERATED SALAD BAR: 1 REQUIRED

A. Vollrath, model 37065 *H011 Signature Server cold food station with the following accessories:
   1. 32" counter top height (verify custom height with Owner before ordering).
   2. 14 gauge stainless steel countertop.
   3. Premier Metal and Glass, model TMIR-A full length double-sided food guard with with 3/8” glass and LED lights as detailed in black matte fine finish. Use counter mount narrow flanges. Seal flanges to counter top.
   4. 30” high full length 14 gauge stainless steel V-rib tray slides for customer and operator sides. Verify tray slide height with Owner before ordering.

5. 98850 Work surface flange modified with line-up locks; keyhole slots on diagonal corners with stainless slide attached to side of base.
6. SS4Casters 4-Series Signature Server swivel casters; two with brakes.
7. Black laminate base panels. Verify with Architect before ordering.

B. Provide submittals for review.

C. Install assembly complete.

ITEM 51 MOBILE DOUBLE-SIDED CASHIER COUNTER: 1 REQUIRED

A. Vollrath, model 37015 *H011 with the following accessories:
1. Full length V-rib 14 gauge stainless steel tray slides (double sided) – match height of Items 49 and 50.
2. Locking cashier drawer.
3. 34” high 14 gauge stainless steel countertop.
4. 98850 Work surface flange modified with line-up locks; keyhole slots on diagonal corners with stainless slide attached to side of base.
5. SS4Casters 4-Series Signature Server swivel casters; two with brakes.
6. 36946 Internal Duplex Receptacle with counter top cutout and grommet (120v).
7. Black laminate base panels on all sides. Verify with Architect before ordering.

B. Provide submittals for review.

C. Install assembly complete.

ITEM 52 POINT OF SALE SYSTEM: 1 REQUIRED

A. Owner furnished and installed.

ITEM 53 MOBILE TRAY/TRASH/RECYCLING COUNTER: 1 REQUIRED

A. Fabricate as detailed and construct top of one piece all welded 14 gauge stainless steel. Reinforce underside of top and install on a cabinet base constructed of 3/4” marine grade plywood with all exposed and accessible surfaces faced with plastic laminate. Include the following:
1. Provide finished openings in top as detailed.
2. Door Hardware: Blum Modul 90-170 hinges; Ives, model Number 2 latches; and Component Hardware, model P46-1012 satin finish stainless steel door pulls.

B. Install cabinet on 6” high all swivel casters; front two with brakes.

PART 3 EXECUTION

3.01 SUPERVISION

A. A competent supervisor, representing the Contractor, shall be present at all times during progress of the Contractor's work.

3.02 SITE EXAMINATION

A. Verify site conditions under the provisions of the General Conditions, Supplementary Conditions and applicable provisions of Division 1 Sections. Notify the Architect, in writing, of unsatisfactory conditions for proper installation of food service equipment.

B. Verify wall, column, door, window, and ceiling locations and dimensions. Fabrication and installation should not proceed until dimensions and conditions have been verified and coordinated with fabrication details.

C. Verify that wall reinforcement or backing has been provided and is correct for wall supported equipment. Coordinate placement dimensions with wall construction Section.

D. Verify that ventilation ducts are of the correct characteristics, and in the required locations.

E. Verify that utilities are available, of the correct characteristics, and in the required locations.

3.03 INSTALLATION

A. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

B. Install items in accordance with manufacturer's instructions.

C. Set each item of non-mobile and non-portable equipment securely in place, leveled and adjusted to correct height. Anchor to supporting substrate where indicated, and where required for sustained operation and use without shifting or dislocation. Conceal anchorages wherever possible. Adjust counter tops and other work surfaces to a level tolerance of 1/16 inch (maximum offset, and plus or minus on dimension, and maximum variation in 2'-0" run from level or indicated slope). Provide anchors, supports, bracing, clips, attachments, etc., as required to comply with the local seismic restraint requirements. The Guidelines for Seismic Restraint of Kitchen Equipment, as prepared for the Sheet Metal Industry Fund of Los Angeles and endorsed by SMACNA, should be followed.

D. Complete field assembly joints in the work (joints which cannot be completed in the shop) by welding, bolting-and-gasketing, or similar methods as indicated and specified. Grind welds smooth and restore finish. Set or trim flush, except for "T" gaskets as indicated.

E. Provide closure plates and strips where required, with joints coordinated with units of equipment.

F. Provide sealants and gaskets all around each unit to make joints airtight, waterproof, vermin-proof, and sanitary for cleaning purposes.

G. Joints up to 3/8 inch wide will be stuffed with backer rod to shape sealant bead properly, at 1/4 inch depth.

H. At internal corner joints, apply sealant or gaskets to form a sanitary cove of not less than 3/8 inch radius.

I. Shape exposed surfaces of sealant slightly concave with edges flush with faces of materials at joint.

J. Provide sealant filled or gasketed joints up to 3/8 inch joint width. Wider than 3/8 inch, provide matching metal closure strips, with sealant application each side of strips. Anchor gaskets mechanically or with adhesives to prevent displacement.

K. Treat enclosed spaces, inaccessible after equipment installation, by covering horizontal surfaces with powdered borax at a rate of 4 ounces per square foot.

L. Insulate to prevent electrolysis between dissimilar metals.

M. Cut and drill components for service outlets, fixtures, piping, conduit, and fittings.

N. Coordinate the installation of approved dry pendant sprinkler head in each cooler and freezer. Sprinkler heads should be installed in coolers/freezers only if required by local codes.

O. Verify and coordinate the mounting heights of all wall shelves and equipment, with equipment located below them for proper clearances.

P. Coordinate with the Plumbing and Electrical Divisions and provide holes in food service equipment for plumbing and electrical service to and through the fixtures, as required. This includes welded sleeves, collars, ferrules, or escutcheons. Locate these services so that they do not interfere with intended use and/or servicing of the fixture. No alterations of the building are allowed without written permission by the General Contractor and/or Architect. (i.e. – routing refrigerant lines).

3.04 ADJUSTING

A. Test and adjust equipment, controls, and safety devices to ensure proper working order and conditions.

B. Repair or replace equipment, which is found to be defective in its operation, including units which are below capacity or operating with excessive noise or vibration.

3.05 CLEANING AND RESTORING FINISHES

A. After completion of installation and completion of other major work in food service areas, remove protective coverings and clean food service equipment internally and externally.

B. Restore exposed and semi-exposed finishes, to remove abrasions and other damages, polish exposed metal surfaces and touch-up painted surfaces. Replace work, which cannot be successfully restored.

C. Polish glass, plastic, hardware and accessories, fixtures, and fittings.

D. Wash and clean equipment and leave in a condition ready for the Owner to sanitize and use.

3.06 TESTING, START-UP AND INSTRUCTIONS

A. Delay the start-up of equipment until service lines have been tested, balanced, and adjusted for pressure, voltage, and similar considerations and until water and steam lines have been cleaned and treated for sanitation.

B. Make arrangements for demonstration of food service equipment operation and maintenance in advance with the Owner/Operator.

C. Demonstrate food service equipment to familiarize the Owner and the Operator on operation and maintenance procedures, including periodic preventative maintenance measures required. Include an explanation of service requirements and simple on-site service procedures as well as information concerning the name, address, and telephone number of qualified local source of service. The individual performing the demonstration shall be knowledgeable of operating and service aspects of the equipment.

D. Provide a written report of the demonstration to the Owner, outlining the equipment demonstrated and malfunctions or deficiencies noted. Indicate individuals present at demonstration.

E. Final Cleaning: After testing and start-up, clean the food service equipment and leave in a condition ready for the Owner to sanitize and use.

3.07 CLEAR AWAY

A. Throughout the progress of their work, the Contractor shall keep the working area free from debris and shall remove rubbish from premises resulting from work being done by them. At the completion of their work, the Contractor shall leave the premises in a clean and finished condition.

END OF SECTION

SECTION 11 5213
PROJECTION SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Front projection screen assemblies.

B. Electric operation.

1.02 RELATED REQUIREMENTS

A. Section 01 6011 - Seismic Anchoring Requirements

B. Section 09 2116 - Gypsum Board Assemblies: Wall framing and system and backing.

C. Section 26 0583 - Wiring Connections: Electrical supply, conduit, and wiring for electric motor operated projection screens.

D. Section 26 0509 - Equipment Wiring: Wiring connections.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Wiring diagrams for motor operators and actuators, and controls and switches.

C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.

D. Samples: For screen fabrics, submit two samples 6 by 6 inch in size.

E. Installer's Qualification Statement.

F. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.

B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.

C. Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

A. Maintain interior of building between 60 degrees F and 80 degrees F during and after installation of projection screens.

PART 2 PRODUCTS

2.01 FRONT PROJECTION SCREENS - ELECTRIC

A. Front Projection Screens: Factory assembled unless otherwise indicated.
   1. Located in Gymnasium, Media Center: Motorized, matte light diffusing fabric screen, horizontally tensioned, wall mounted.
      a. Screen Viewing Area:
         1) Gymnasium: 192 inches wide by 120 inches high, 217-1/4 inch enclosure.
         2) Media Center: 116 inches wide by 72 1/2 inches high, 143-1/4 inch enclosure.
   2. Located in Cafeteria: Motorized, matte light diffusing fabric screen, horizontally tensioned, wall mounted.
      a. Screen Viewing Area: 116 inches wide by 72 1/2 inches high, 143-1/4 inch enclosure.

B. Matte Light Diffusing Fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.
   1. Material: High contrast gray vinyl without backing, with nominal gain of 0.8 over viewing angle not less than 70 degrees from axis, horizontally and vertically.
   2. Seams: No seams permitted in fabric.

C. Masking Borders: Black, on four sides.

D. Extra Drops: Black; as required to properly position viewable area of screen.

E. Exposed Screen Cases: Steel, with integral roller brackets.
   1. Finish: Baked enamel.
   2. Color: White.
   3. End Caps: Steel; finished to match case.
   4. Mounting: Wall.

F. Electrically-Operated Screens:
   1. Roller: Steel, 2 inch in diameter, with locking device.
   2. Vertical Tensioning: Screen fabric weighted at bottom with steel bar and plastic end caps.
   3. Horizontal Tensioning: Tab-guided cable system.

G. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

H. Products:
   1. Cafeteria: Draper Inc., Access V Series: www.draper.com
   2. Gymnasium: Draper Inc., Premier XL Series:www.draper.com
   3. Media Center Draper Inc., Acumen V Series: www.draper.com
   4. Substitutions: See Section 01 6000 - Product Requirements

2.02 ELECTRICAL COMPONENTS

A. Electrical Components: Listed and classified by UL as suitable for the purpose specified and indicated.

B. Motors: Direct drive, 110 V, 60 Hz.
   1. Screen Motor: Mounted inside roller; three wire with ground; quick reverse type and lifetime lubricated; equipped with thermal overload cut-off, internal junction box, electric brake, and pre-set accessible limit switches.
      a. Electrical Characteristics: 1.2 amps.
      b. Motor mounted on sound absorber.
   2. Door and Adjustable Masking Motor: Mounted inside roller; three wire with ground; quick reverse type; equipped with thermal overload cut-off.
      a. Electrical Characteristics: 1.2 amps.

C. Controls: Three (3) position control switch with plate.
   1. Provide 1 control station to screen, with internal override to prevent more than one signal reaching the screen.

2. Security: Provide key operated switch; provide 2 keys.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is finished and ready to accept screen installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that openings for recessed screens are correctly sized.

D. Verify type and location of electrical connections.

E. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.02 PREPARATION

A. Coordinate screen installation with installation of projection systems.

B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on drawings.

D. Install plumb and level.

E. Install electrically operated screens ready for connection to power and control systems by others.

F. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

G. Test electrical screens for proper working condition. Adjust as needed.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7900 - Demonstration and Training for addtional requirements.

B. Demonstration and instruct Owner in operation and maintenance of operable units.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION 11 5213

SECTION 11 6123
RETRACTABLE STAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Retractable stage system.

B. Electric operation.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood shroud and skirt material

B. Section 09 6466 - Wood Athletic Flooring: Finish for platform.

C. Division 26 - Electrical: Electrical service and connections.

1.03 REFERENCE STANDARDS

A. CAN/CSA S16.1-94 Limit States Design of Steel Structures

B. CAN/CSA S136-94 Cold Formed Structural Steel Members

C. CSA 086.1-94 Engineered Design in Wood

D. CAN3-S157-M83 Strength Design in Aluminum

E. W59-M1989 Welded Steel Construction

F. W59-M1991 Welded Aluminum Construction

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified system, describing physical, performance characteristics, and operations; components; electrical requirements.

C. Finish Options: Submit finish options for selection.

D. Shop Drawings: Submit for complete system with all components and rough-in requirements.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested maintenance schedule.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified, with minimum five years experience.

B. Installer: Company specializing in performing work of the work specified with minimum three years experience and approved by manufacturer.

1.06 WARRANTY

A. Refer to Section 01 7000 - Execution and Closeout Requirements, for warranty procedures.

B. Provide guarantee for all work performed under these specifications to be free from defects for a period of one year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Sheridan Gymnasium Equipment Limited, Madsen RS-1 Surface Mounted: www.sheridanseating.com.

B. Other Acceptable Manufacturers:

1. Stagecraft Industries: www.stagecraftindustries.com.
2. MasterCraft Renovation Systems: www.mastercraftbleachers.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RETRACTABLE STAGE

A. General: Surface mounted retractable platform stage system with wood panel shroud surround.

B. Platform: Aluminum modular substructure; 5/8" thick plywood subfloor; wood athletic flooring finish.

1. Size: 12 feet x 20 feet; 24 3/4 inches high; or as indicated on Drawings.
2. Structural Capacity: Vertical live load of 100 lbs./sq.ft. over the platform; vertical live load of 120 lbs. per linear ft., and concentrated load of 500 lbs..
3. Operation: Heavy duty electrically operated winching mechanism controlled by a key operated safety switch and concealed limit switches; automatic and positive lock in the extended position without the use of floor locks.
   a. 208v, 3-ph, ¾-hp, instant reverse motor, magnetic starter, overload protection.
   b. Flush-mounted key switch and three safety limit switches.
4. Skirt: White Maple hardwood plywood skirt board.
5. Steps: Detachable, portable safety-tread steps with handrails on both sides.
6. Ramp: Detachable, portable ramp with handrails on both sides.
7. Shroud: White maple hardwood plywood panels. Configuration as indicated on Drawings.

2.03 FABRICATION

A. Fabricate Retractable Stage in accordance with reviewed and accepted shop drawings.

B. Vertical steel columns shall be structural steel tubing.

C. Provide 5 inch x 1-1/2 inch non-marking urethane wheels and non-marking adjustable rubber bumpers.

D. Provide Auto-Loc safety device; fully automatic device to bring the stage to an immediate stop; breaking mechanism to be estivated by both inertia (quick jerk) and/or centrifugal force (faster than normal speed).

E. Provide mechanism to automatically and positively lock stage in the extended position without the use of floor locks.

F. Permanently couple rolling frame to adjacent frame to ensure positive engagement and alignment of vertical frames.

G. Provide minimum 5/8" thick plywood sub floor, fastened to sub frame with countersunk screws; prepare for installation of hardwood flooring specified in Section 09 6466.

H. Provide solid, premium grade, white maple skirt board along front and sides of stage.

I. Provide white maple species; PS 20, AWI Premium grade; plain sawn, smooth texture; suitable for clear finish at for vertical shroud around stage, complete with support framing and hardwood corner trim.

J. Provide removable panel at center, top for access to motor.

PART 3 EXECUTION

3.01 GENERAL

A. Verify that areas are free of impediments interfering with the installation and that substrates are acceptable to receive the stage in accordance with the manufacturer's recommendations.

B. Verify electrical wiring is as required for operation of the stage.

3.02 INSTALLATION

A. Install retractable stage in accordance with the manufacturer's instructions and final shop drawings.

B. Adjustment and Cleaning: Upon completion of installation, Retractable Stage Subcontractor shall adjust assembly to operate in compliance with manufacturer's recommendations. Retractable Stage Subcontractor shall clean installed stage on exposed or semi-exposed surfaces.

C. Coordinate installation of wood flooring specified in Section 09 6466.

3.03 DEMONSTRATION

A. Refer to Section 01 7900 - Demonstration and Training, for additional requirements.

B. Manufacturer's representative or Retractable Stage installer to demonstrate the proper method of operation of the stage to the Owner upon completion of the work.

END OF SECTION 11 6123

SECTION 11 6623
GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basketball backboards, goals, and support framing.

B. Wall mounted protection pads.

1.02 RELATED REQUIREMENTS

A. Section 05 2100 Steel Joist Framing: Roof framing system

B. Section 05 5000 - Metal Fabrications: Secondary structural members supporting gymnasium equipment.

C. Section 09 6466 - Wood Athletic Flooring: Gymnasium flooring.

D. Section 26 0583 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

B. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

B. Electrically Operated Equipment: Coordinate location and electrical characteristics of service connection.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:
   1. Electrical characteristics and connection locations.
   2. Structural steel welder certifications.
   3. Manufacturer's installation instructions.

C. Shop Drawings: For custom fabricated equipment indicate, in large scale detail, construction methods; method of attachment or installation; type and gauge of metal, hardware, and fittings; plan front elevation; elevations and dimensions; minimum one cross section; utility requirements as to types, sizes, and locations.

D. Erection Drawings: Detailed dimensional requirements for proper location of equipment.

E. Selection Samples: Submit samples of wall pad coverings in manufacturer's available range of colors.

F. Operating and maintenance data for each operating equipment item.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.

B. Installer Qualifications: Company specializing in performing work of the type specified with minimum three years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.

B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.

C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

1.08 PROJECT CONDITIONS

A. Coordinate size of access and route to place of installation.

B. Coordinate equipmwnt installation with size, location and installation of service utilities.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gymnasium Equipment:
   1. Draper, Inc: www.draperinc.com/#sle.
   2. Performance Sports Systems: www.perfsports.com/#sle.
   3. Porter Athletic Equipment Company: www.porterathletic.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL REQUIREMENTS

A. See drawings for sizes and locations, unless noted otherwise.

B. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of Contract Documents.

C. Hardware: Heavy duty steel hardware, as recommended by manufacturer.

D. Electrical Wiring and Components: Comply with NFPA 70; provide UL-listed equipment.

E. Structural Steel Fabrications: Welded in accordance with AWS D1.1/D1.1M, using certified welders.

2.03 EXTERIOR BASKETBALL

A. Column-Mounted Backstop Assemblies: Column-mounted; stationary; mounted to exposed column flange; capable of mounting both rectangular and fan-shaped backboards.
   1. Products:
      a. Arizona Courtlines, Inc. Model GN-44.
      b. Performance Sports Systems Model GN45.
      c. Sports Specialties Model SS402-800 Out Door Backstop.
   2. Material: 4-1/2 inch o. d. x 0.18 inch wall gooseneck galvanized pipe with mounting plate for direct goal attachment for the backboard.
      a. Provide 2 braces extending from the upper mounting points of the backboard to the gooseneck extension.
   3. Distance From Column Face: 4 feet unless otherwise indicated.
   4. Framing Color: Galvanized, unpainted.
   5. Installation: Direct burial in concrete with minimum 36 inch extension into concrete. Concrete to be minimum of 24 inch diameter by 42 inches deep below grade.

B. Backboards: Steel, fan shaped.
   1. Products:
      a. Arizona Courtlines, Inc. Model FBB-ST
      b. Performance Sports Systems Model 1245T.

c. Sports Specialties Model SS413-208.

2. Material: Minimum 12 gage steel stamped shell with minimum 12 gage formed horizontal mounting channels and a 10 gage formed vertical channel welded to reverse side.
3. Dimensions: 35 inches high by 54 inches wide
4. Thickness: 1-1/2 inches.
5. Markings: Powder coated.
6. Provide mounting kit.
7. Color: Manufacturer's standard.

C. Goals: Steel rim, mounted to backboard, with attached nylon net; complete with mounting hardware.
1. Products:
a. Arizona Courtlines, Inc. Model FM-3
b. Performance Sports Systems Model 7550.
c. Sports Specialties Model SS411-556.
2. Net Attachment Device: Continuous no-tie ring.
3. Tested to 1000 lbs. static load.
4. Finish: Powder coat orange.

D. Extent of Work: Provide backboard and goal at covered play area with support by others. Provide backboard, goal, support post and footing elsewhere.

2.04 INTERIOR BASKETBALL

A. Basketball System: Backstop assembly, backboard, and goal.

B. Wall-Mounted Backstop Assemblies: Wall-mounted steel frame assembly capable of mounting both rectangular and fan-shaped backboards.
1. Distrance of Backboard from Wall: Field verify
2. Framing: Side-folding retractable framing.
3. Folding Operation: Manual
4. Height Adjuster: Raises or lowers assembly by 2 feet to adjust goal height.
a. Height Control System: Manual winch.
5. Framing Color: White.
6. Basis of Design: Draper, Inc.,EZ Fold DGW Side-Fold Wall-Mounted: www.draperinc.com

C. Ceiling-Suspended Backstop Assemblies: Capable of mounting both rectangular backboards.
1. Framing: Center strut; forward folding framing.
2. Folding Control System: Electric hoist that folds backstop with 115 volt actuator, integral limit switches that provide automatic shut-off in both positions, and safety catch with automatic reset. Wall-mounted, key-secured, recessed control, location as directed by Architect.
3. Height Adjuster: Raises or lowers assembly by 2 feet to adjust goal height.
a. Height Control System: Manual winch.
4. Framing Color: White.
5. Basis of Design: Draper, Inc.; EZ Fold Ceiling Suspended Forward-Folding: www.draperinc.com

D. Backboards: Tempered glass, rectangular shaped.
1. Frame: Brushed aluminum edge, steel mounting.
2. Markings: Painted.
3. Provide safety padding for bottom edge of backboard.
4. Provide mounting kit.
5. Color: White with gray padding.

E. Goals: Steel rim, mounted to backboard, with attached nylon net; complete with mounting hardware.
1. Net Attachment Device: Wire ties.
2. Breakaway mechanism, adjustable.
3. Provide safety pad for goal mounting.

4. Finish: Powder coat orange.

2.05 WALL PADDING

A. Wall Padding: Foam filling bonded to backing board, wrapped in covering; each panel fabricated in one piece.
   1. Surface Burning Characteristics: Flame spread index (FSI) of 25 or less, smoke developed index (SDI) of 450 or less, Class A, when tested in accordance with ASTM E84 as a complete panel.
   2. Flammability: Comply with NFPA 286.
   3. Covering: Vinyl-coated polyester fabric, mildew and rot resistant; stapled to back of board.
      a. Color: As selected from manufacturer's standard range.
      b. Texture: Embossed leather-look.
      c. Fabric Weight: 14 oz/sq yd, minimum.
   4. Foam, Fire-Rated: Open cell polychloroprene (Neoprene), with 5.5 pcf nominal density.
   5. Foam Thickness: 1-1/2 inches.
   6. Backing Board: Plywood.
      a. Thickness: 3/8 inch, minimum.
   7. Panel Dimensions: 24 inches wide by 48 inches long, no fastener margins.
   8. Fastening Margins: 1 inch wide, covered by fabric covering.
   9. Mounting: Removable; Z-clips fixed to wall and to padding.
   10. Manufacturers:
      a. ADP Lemco, Inc: www.adplemco.com/#sle.
      b. Draper, Inc; EcoVision Wall Pad: www.draperinc.com/#sle.
      c. IPI by Bison, Inc; Indoor Solid Color Vinyl Padding: www.ipibybison.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.

B. Inspect areas and conditions before installation, and notify Architect in writing of unsatisfactory or detrimental conditions.

C. Do not proceed with this work until conditions have been corrected; commencing installation constitutes acceptance of work site conditions.

D. Verify that electrical services are correctly located and have proper characteristics.

3.02 INSTALLATION

A. Install in accordance with Contract Documents and manufacturer's instructions.

B. Install equipment rigid, straight, plumb, and level.

C. Secure equipment with manufacturer's recommended anchoring devices.

D. Install wall padding securely, with edges tight to wall and without wrinkles in fabric covering.

E. Separate dissimilar metals to prevent electrolytic corrosion.

3.03 ADJUSTING

A. Verify proper placement of equipment.

B. Verify proper placement of equipment anchors and sleeves, and use actual movable equipment to be anchored if available.

C. Adjust operating equipment for proper operation; remove and replace equipment causing noise or vibration; lubricate equipment as recommended by manufacturer.

3.04 CLEANING

A. Remove masking or protective covering from finished surfaces.

B. Clean equipment in accordance with manufacturer's recommendations.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7900 - Demonstration and Training for additonal requirements.

B. Instruct and demonstrate to owner the operation and maintenance of operable units.

3.06 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION 11 6623

SECTION 11 8226
FACILITY WASTE COMPACTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self Contained Compactor

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Placement of anchor bolts and inserts into concrete.

1.03 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

B. NEMA MG 1 - Motors and Generators; 2018.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures for submittal procedures.

B. Product Data: Provide unit capacities, physical dimensions, utility requirements and locations, point loads.

C. Shop Drawings: Indicate machine location, rough-in and anchor placement dimensions and tolerances, clearances required and tolerances, clearances required.

D. Manufacturer's Installation Instructions: Indicate special installation requirements.

E. Operation Data: Include description of system operation, adjusting and testing required.

F. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Marathon Ramject, "Pak'ntainer" MP2 FL4.

B. Substitutions: Not permitted.

2.02 APPLICATIONS

A. Compactor Elementary School Utility Court: Stationary type, top intake, ground-fed.
   1. Service Conditions: Exterior, under cover.
   2. Container Size: 4 cu yd.

2.03 COMPACTORS - GENERAL

A. Motors: NEMA MG 1.

B. Control Panels and Remote Equipment Enclosures: NEMA 250 Type 4 enclosures; factory finished; wall-mounted unless otherwise indicated.

C. Discharge Containers: Heavy duty steel; factory-finished for outdoor use; manufacturer's standard type unless otherwise indicated.

D. Anchors and Fasteners: Galvanized steel; where embedded in concrete, provide to concrete installer for installation.

2.04 SELF CONTAINED COMPACTORS

A. Self Contained Compactor:
   1. Charge Chamber: 0.5 cubic yard with 22.5 inch long by 46 inch clear feed opening
   2. Waste Intake: Rear feed hopper with slide lid
   3. Rear feed basket style dumper to work with 44 gallon Rubbermaid Brute containers.
   4. Multi-cycle timer
   5. Color coded pressure gauge container fullness indicator.
   6. Container guides: 3 inch by 3 inch by 3/8 inch angle iron with 6 inch by 6 inch stops.
   7. Container; 4 cubic yard, water tight.
      a. Protective coating: Spray-applied polyurea coating on interior surfaces.
         1) Tensile strength: 3000psi
         2) Tear strength: 750 lbs/in
         3) Elongation: 200%
         4) Hardness: 55-57 Shore D
   8. Safety interlocked gate/door. Compactor will not operate when gate/door is open.
   9. Key actuated start and red button stop.
   10. Operator: 3 horsepower electric motor, 480 volt 3 phase power.
      a. Remote stand alone power unit.
         1) Controls and Safeties: Fully automatic operation.
            (a) "On/Off" key switch.
            (b) Automatic photoelectric sensor start and stop.
            (c) Emergency stop button.
            (d) "Container-Full" indicator light.
            (e) Magnetic door and container interlock.
            (f) Container removal safety signal.
            (g) Built-in container stops.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install unit and inlet hopper in accordance with manufacturer's instructions and with standards required by authorities having jurisdiction.

B. Coordinate with waste chute discharge.

C. Coordinate location of controls so that operator doesn’t have to walk over hydraulic hoses to access lid.

D. Anchor unit securely in place.

E. Adjust unit mechanism to achieve specified requirements.

3.02 CLOSEOUT ACTIVITIES

A. Demonstrate and instruct Owner on unit operation, and describe unit limitations.

END OF SECTION 11 8226

SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

B. Interior motorized roller shades.

C. Motor controls.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Concealed blocking for attachment of recessed boxes.

B. Division 26 - Electrical: Electrical service and connections.

1.03 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

D. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

E. WCMA A100.1 - Safety of Window Covering Products; 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

D. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum three years of experience with shading systems of similar size and type.

1.07 MOCK-UP

A. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets when applicable.
   1. Full-sized mock-up may become part of the final installation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: Five years.
   2. Electric Motors: Five years.
   3. Electronic Control Equipment: Five years.
   4. Fabric: Five years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com/#sle.
   3. MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Motorized Roller Shades, Motors and Motor Controls:
   1. Draper, Inc; Motorized FlexShade: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural; RB500 Motorized Roller Shades: www.hunterdouglasarchitectural.com/#sle.
   3. MechoShade Systems LLC; Electroshade: www.mechoshade.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

C. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.
   3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
      a. Comply with NFPA 70.
      b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.

c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.

B. Interior Roller Shades - Type A - Manual - Basis of Design: Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
   1. Description: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
      a. Mounting: Inside jamb or header mounted in instances of multiple shades
      b. Size: As indicated on drawings.
      c. Fabric: As indicated under Shade Fabric article.
   2. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Hardware Type as follows:
         1) A1: Inside jamb or header mounted in instances of multiple shades.
         2) A2: Not Used.
   3. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
      a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
   4. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
   5. Manual Operation:
      a. Clutch Operator Location: As indicated on drawings.
      b. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
      c. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pounds minimum breaking strength. Provide upper and lower limit stops.
      d. Chain Retainer:
         1) Chain tensioning device complying with WCMA A100.1.
         2) Manufacturer's standard clip.
   6. Accessories:
      a. Exposed Headbox: Extruded aluminum, size as required to conceal shade mounting; clear anodized finish.
         1) Color: As selected.
      b. End Cap Covers: Match headbox finish.
      c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

C. Interior Roller Shades - Type B, Motorized - Basis of Design: Draper, Inc; Motorized FlexShade: www.draperinc.com/#sle.
   1. Locations: Gymnasuim walls and as indicated on Drawings.
   2. Description: Single roller, motor-operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
      a. Drop Position: Regular roll.
      b. Mounting: CMU head mounted.
   3. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Hardware Type: Universal brackets.

4. Multiple Shade Operation: Provide hardware as necessary to operate more than one shade using a single motor.
5. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
    a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
    d. Roller tubes to be capable of being removed and reinstalled without affecting roller shade limit adjustments.
6. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
7. Shade Motor: Standard 120V AC motor.
8. Accessories:
    a. Exposed Headbox: Extruded aluminum, size as required to conceal shade mounting; anodized finish.
        1) Color: As selected.
    b. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric for Light-Filtering Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Material: 100 percent polyester.
2. Material Certificates and Product Disclosures:
    a. Cradle to Cradle Material Health Certificate: Achievement level of Bronze.
3. Performance Requirements:
    a. Flammability: Pass NFPA 701 large and small tests.
    b. Fungal Resistance: No growth when tested according to ASTM G21 for ATCC9642, ATCC9348 and ATCC9645.
4. Openness Factor: 1 percent.
5. Roll Width: As required.
6. Color: As selected by Architect from manufacturer’s full range of colors.
7. Extent: As indicated on drawings.

B. Fabric for Room-Darkening Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Material: 100 percent polyester.
2. Performance Requirements:
    a. Flammability: Pass NFPA 701 large and small tests.
    b. Fungal Resistance: No growth when tested according to ASTM G21 for ATCC9642, ATCC9348 and ATCC9645.
3. Openness Factor: 0% (blackout)
4. Roll Width: As required.
5. Color: As selected by Architect from manufacturer’s full range of colors.
6. Extent: In Gynnasium and as shown on drawings.

2.04 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

B. Provide all components and connections necessary to interface with other systems as indicated.

C. Manual Controls:

1. Control Functions:
    a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
    b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.
    c. Raise: Raise controlled shade(s) only while button is pressed.
    d. Lower: Lower controlled shade(s) only while button is pressed.
    e. Multiple Shade Groups: Provide individual controls for each shade group as indicated.
2. Wall Controls: Provided by shade manufacturer.
    a. Finish: To be selected by Architect.
    b. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.
    c. Keyed Controls: Provide controls that require a key to function.

2.05 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
    1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
    2. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Installation tolerances:
    1. Maximum Offset From Level: 1/16 inch.

C. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

D. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. 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 two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 12 2400

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).

C. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. WP-1 Material for Finish Carpentry, Architectural Wood Casework, and Countertops to be purchased from same lot and finished by same finisher.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: See Section 06 4100.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Manufacturers:
         1) Arborite: www.arborite.com/#sle.
         2) Formica Corporation: www.formica.com/#sle.
         3) Lamin-Art, Inc: www.laminart.com/#sle.
         4) Wilsonart: www.wilsonart.com/#sle.
         5) Substitutions: See Section 01 6000 - Product Requirements.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. Finish: Matte or suede, gloss rating of 5 to 20.
      d. Surface Color and Pattern: As indicated on drawings.
   2. Back and End Splashes: Same material, same construction. Where indicated on drawings.

C. Apple Ply Plywood Countertops: One-piece, glued-laminated under pressure.
   1. Product: ApplePly Premium Hardwood Panels by States Industries.
   2. Thickness: 3/4 inch, minimum.
   3. Species: 1/16-inch thick alder and birch, White Maple Species Veneer.
   4. Exposed Edges: Sanded smooth and rounded to approximately 3/8 radius
   5. Extent of Work: WP - 2, where indicated on drawings.

D. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) Avonite Surfaces: www.avonitesurfaces.com/#sle.
         2) Dupont: www.corian.com/#sle.
         3) Wilsonart: www.wilsonart.com/#sle.
         4) Substitutions: See Section 01 6000 - Product Requirements.
      b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      d. Color and Pattern: As indicated on drawings.
   3. Other Components Thickness: 1/2 inch, minimum.

2.02 MATERIALS

A. Wood-Based Components: As specified in Section 06 4100.

B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 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.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch.

D. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 12 3600

SECTION 12 5210
UPHOLSTERED SEATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabric wrapped foam built in bench cushions.

1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework..

B. Section 06 2000 - Finish Carpentry

1.03 REFERENCE STANDARDS

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of fabric wrapped cushions with size, location and installation of cabinets and wall supports as shown on drawings.

1.05 SUBMITTALS

A. See Section 01 3300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's product data for fabric and foam components.

C. Samples: Submit one sample seat cushion, 12 x 18 inch minimum in size, illustrating construction, fabrication and mounting details. Submit two 12 x 18 inch samples of fabric cover material.

D. Shop Drawings: Complete, detailed layout with complete dimensioning information for fabrication and installation.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Stock Materials: 10 square feet of each kind of fabric.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabric wrapped foam cushions to project site in protective wrappers.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: All materials, construction and finishing shall be of the highest quality to produce movable furniture that is equal or superior to the industry standard.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

C. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.02 FABRIC TYPE: FA-1

A. Manufacturer: Momentum Textiles, www.momentumtextiles.com
   1. Pattern: Silica Etc.
   2. Product number: 09193831
   3. Color: As indicated in Finish Legend.
   4. Content: 100% Silicone.
   5. Width: 54”
   6. Backing: Polyester

7. Repeat:
    a. Approximate Horizontal: 6-1/8 inch
    b. Approximate Vertical: 4-7/8 inch
8. Performance Data
    a. Flammability Testing:
        1) Pass* - Test Method - California Technical Bulletin 117, Section E.
        2) When combined with appropriate components can pass California Technical Bulletin #133, NY and NJ Port Authority and Boston Fire Code assembly tests.
    b. Durability:
        1) 500,000 + Double Rubs - Test Method - Wyzenbeek

2.03 FOAM

A. Hybrid foam: 50% non-petroleum based Polyols, 50% petroleum-based Polyols. Non-petroleum based content shall be derived from a renewable resource such as soy.
    1. Seats: 2” 22035CFR hybrid foam base, 1” 18024CFR hybrid foam top layer and side layers.

2.04 ACCESSORIES

A. Concealed Fasteners: Type recommended by fabricator.

B. Velcro: Type recommended by fabricator. Provide heavy duty velcro at each cushion suitable to hold cushions in place.

C. Adhesive: Type recommended by fabricator and complying with the project's VOC requirments..

2.05 FABRICATION

A. Tight/monolithic construction; no loose, semi-attached or attached cushions.

B. Seat and back are foamed and upholstered individually. All exposed surfaces covered with specified fabric.

C. All seams shall be reinforced, utilizing heavy duty, commercial quality thread of fiber compatible with upholstery fiber compositions.

D. Long horizontal edges to be gently rounded with no exposed seams along front, back, top and bottom edges. Side edges to be neatly welted with matching fabric.

E. All horizontal planes shall be parallel and level for full extent, and at 90 degrees with vertical planes for full extent of all intersections.

F. Foam shall be cut to crown at seams so that a consistent level at all horizontal and vertical planes is maintained upon foam compression with use.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Do not begin installation until spaces to receive cushions have been completed.

B. Coordinate with casework manufacturer to prepare mounting surfaces using the methods recommended by the cushion fabricator for achieving the best result for the project conditions.

3.03 INSTALLATION

A. Install in accordance with fabricator's instructions.

B. Install cushions as indicated on Drawings, level and plumb, with separate units securely anchored.

C. At benches greater than 5 feet provide 2 cushions.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 12 5210

SECTION 12 9313
BICYCLE RACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Indoor bicycle racks.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Support System

B. Section 32 3300 - Site Furnishings: Exterior bicycle racks.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle racks and accessories with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 BICYCLE RACKS AND ACCESSORIES

A. Indoor Bicycle Racks: Device designed for indoor/outdoor storage of bicycles; allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.
   1. Style: Indoor, wall mounted, single level, vertical, single-sided storage rack with folding arms and locking loops; does not require teh lifting of bikes.
   2. Capacity: One bicycle per rack.
   3. Layout: As indicated on the Drawings.
   4. Finish: Powder coat, maintenance-free and weather-resistant.
   5. Color: Black.
   6. Anchors: to suit application; not to be supported by brick veneer.
   7. Product:
      a. Steadyrack, Fender Rack: www.steadyrack.com
      b. Substitutions: See Section 01 6000 - Product Requirements

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive bicycle racks and accessories..

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install bicycle racks and accessories level, plumb, square, and correctly located as indicated on drawings.

3.03 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

END OF SECTION 12 9313

SECTION 14 2400

HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete hydraulic elevator systems.
   1. Passenger type.

B. Elevator Maintenance Contract.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Includes elevator machine foundation and elevator pit.

   Section 05 1200 - Structural Steel Framing: Includes hoistway framing, divider beams, and overhead hoist beams.

B. Section 05 5000 - Metal Fabrications: Includes elevator pit ladder and overhead hoist beams.

   Section 07 1713 - Bentonite Panel Waterproofing: Waterproofing of elevator pit walls and floor.

C. Section 07 8400 - Firestopping: Fire rated sealant in hoistway.

D. Section 08 3100 - Access Doors and Panels: Fire rated access doors into hoistway.

E. Section 09 2116 - Gypsum Board Assemblies: Gypsum shaft walls.

F. Section 09 6816 - Sheet Carpeting: Floor finish in car.

G. Section 10 4400 - Fire Protection Specialties: Fire extinguisher at elevator machine area.

H. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in hoistway.

I. Section 22 0513 - Common Motor Requirements for Plumbing Equipment: Motor for sump pump in pit.

J. Section 26 0533.13 - Conduit for Electrical Systems:

K. Section 26 0583 - Wiring Connections:
   1. Electrical characteristics and wiring connections.
   2. Electrical service to main disconnect located in elevator machine room.
   3. Electrical service for machine room, convenience outlets, and elevator pit.
   4. Lighting in elevator pit.
   5. Conduit for telephone service to location(s) as indicated on drawings.

L. Section 28 4600 - Fire Detection and Alarm:
   1. Fire and smoke detectors and interconnecting devices.
   2. Fire alarm signal lines to elevator controller cabinet.

M. Division 26 - Electrical: Electrical service for elevators to and including fused disconnect switches at machine room and provision for emergency power.

N. Division 27 - Communications: Telephone service to elevators.

O. Division 28 - Electronic Safety and Security: Smoke detectors in elevator lobbies to initiate emergency recall operation, heat detectors in shafts and machine rooms to disconnect power from equipment before sprinkler activation, connection to elevator controllers, access control for elevators and coordination with building fire alarm system.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. AISC 360 - Specification for Structural Steel Buildings; 2016.

D. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASME A17.1 - Safety Code for Elevators and Escalators; 2019.

G. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; 2017.

H. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2020.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

K. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.

M. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

N. NEMA MG 1 - Motors and Generators; 2018.

O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.

Q. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 DEFINITIONS

A. Defective Elevator Work: Repeated operation or control systems failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe condiitons; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected and unsatisfactory conditions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
      a. Telephone service for machine room.
      b. Elevator pit for lighting and sump pump.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
   1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

C. Construction Use of Elevator: As approved by Owner's Project Manager0.

1.06 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design elevator and elevator systems, including comprehensive engineering analysis by a qualified professional engineer licensed in the State of Oregon, using performance requirements and design criteria indicated.

B. Delegated-Design Submittal: For elevator and elevator systems indicated to comply with performance requirements and design criteria, including product data and, where applicable, engineering judgment drawings signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Submit submittals as "Deferred Submittals" in accordance with Section 01 3000 Administrative Requirements. Transmit a copy of each submittal indicating agency approval to the Architect for record.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
   1. Show plan, elevations, sections and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction and locations of equipment and signals. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
   2. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
   3. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
   4. Loads on hoisting beams.
   5. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   6. Clearances and over-travel of car.
   7. Locations in hoistway and machine room of traveling cables and connections for car lighting and telephone.
   8. Location and sizes of hoistway and car doors and frames.
   9. Calculated heat dissipation of elevator equipment in machine room.
   10. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
   11. Interface with building security system.
   12. Electrical characteristics and connection requirements.
   13. Show arrangement of elevator equipment in machine room so rotating elements, sheaves, and other equipment can be removed for reparis or replaced without disturbing other components. Allow for clear passage of equipment through access openings.

D. Samples: Submit two samples, in manufacturer's standard size and texture illustrating cab interior finishes, cab and hoistway door and frame finishes, and handrail material and finish.

E. Manufacturer Confirmation:Signed bythe elevator manufacturer certifying that the hoistway and pit layout and dimensions, as shown on drawings, and electrical service, as shown and specified, are adequate for the elevator system being provided.

F. Testing Agency's Qualification Statement.

G. Inspection and Acceptance Certificates and Operating Permits:As required by authorities having jurisdiction for normal, unrestricted elevator use.

H. Initial Maintenance Contract.

I. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
   1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

J. Operation and Maintenance Data:
   1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
   2. Operation and maintenance manual.
   3. Legible schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.08 QUALITY ASSURANCE

A. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Perform the work in accordance with applicable codes and as supplemented in this section.

C. Manufacturer Qualifications: An approved manufacturer specializing in manufacturing the products specified in this section with minimum fifteen years documented experience in manufacturing, installing and servicing elevators of the type required for the project.

D. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 5 years of satisfactory experience installing elevators equal in character and performance to the project elevators. Trained personnel and supervisor on staff of elevator equipment manufacturer.
   1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
      a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.

E. Regulatory Requirements:
   1. ICC A117.1 Accessible amd Usable Building and Facilities
   2. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
      a. Seismic Risk zone: Project is located in Zone 3 or greater.
   3. Building Code: Oregon Structural Specialty Code, current edition
   4. NFPA 70 National Electrical Code.
   5. NFPA 80 Fire Doors and Windows.
   6. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
   7. Section 407 in ICC A117.1

F. The manufacturer shall have a documented, on-going quality assurance program.

G. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

H. Inspection and testing:
   1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
   2. Arrange for inspections and make required tests.
   3. Deliver to the Owner upon completion and acceptance of elevator work.

I. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.09 DELIVERY, STORAGE AND HANDLING

A. Manufacturer shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

B. Store materials, components and equipment in manufacturere's original protective packaging in a dry, protected area.

C. Handle materials in accordance with manufacturer's recommenations to prevent damage, soiling or deterioration.

1.10 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry ofr elevator equipment. Furnish templates and installation instructions and deliver to Project Site in time for installation.

B. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights and switches in pits.

1.11 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Hydraulic Elevators: Otis Elevator Company; Hydrofit MRL.

B. Other Acceptable Manufacturers - Hydraulic Elevators:
   1. Otis Elevator Company: www.otis.com/#sle.
   2. ThyssenKrupp Elevator: www.thyssenkruppelevator.com/#sle.

C. Substitutions: See Section 01 6000 - Product Requirements.

D. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier .

2.02 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator, MRL Type:
   1. Hydraulic Elevator Equipment:
      a. Holeless hydraulic with cylinder mounted within hoistway.
   2. Drive System:
      a. Variable voltage variable frequency (VVVF) to modulate motor speed.
   3. Operation Control Type:
      a. Selective Collective Automatic Operation Control.
   4. Service Control Types:
      a. Standard service control.
   5. Interior Car Height: 120 inch.
   6. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
   7. Rated Net Capacity: 3000 pounds.
   8. Rated Speed: 125 feet per minute.
   9. Hoistway Size: As indicated on drawings.
   10. Interior Car Platform Size: As indicated on drawings.
   11. Elevator Pit Depth: 48 inch.
   12. Overhead Clearance at Top Floor: 144 inch.
   13. Travel Distance: As indicated on drawings.
   14. Number of Stops: 3.
   15. Number of Openings: 3 Front.
   16. Hydraulic Equipment Location: In shaft

2.03 COMPONENTS

A. Elevator Equipment:
   1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70. Refer to Section 26 0583
   2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
   3. Buffers:
      a. Spring type for elevators with speed less than or equal to 200 feet per minute.
      b. Oil type for elevators with speed greater than 200 feet per minute.
   4. Lubrication Equipment:

a. Provide grease fittings for periodic lubrication of bearings.

B. Electrical Equipment:
1. Motors: NEMA MG 1.
2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70.
3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
4. Include wiring and connections to elevator devices remote from hoistway.

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
1. Complying with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1, ASCE 7 and other related requirements.
2. Provide earthquake emergency operations in accordance with ASME A17.1 requirements.

E. Perform welding of steel in accordance with AWS D1.1/D1.1M.

F. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

G. Perform electrical work in accordance with NFPA 70.

H. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).

2.05 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.
1. Key Card access operation.
2. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
3. Landing Indicator Panels: Illuminating.
4. Comply with ADA Standards for elevator controls.

B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.

C. Door Operation Controls:
1. Program door control to open doors automatically when car arrives at floor landing.
2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

D. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).

2.06 OPERATION CONTROL TYPE

A. Selective Collective Automatic Operation Control: Applies to car in single elevator shaft.
1. Refer to description provided in ASME A17.1.
2. Automatic operation by means of one button in the car for each landing served and by "UP" and "DOWN" buttons at the landings.
3. Stops are registered by momentary actuation of landing car buttons without consideration of the number of buttons actuated or the sequence buttons are actuated, but the stops are made in the order that landings are reached in each direction of travel.
4. All "UP" landing calls are made when car is traveling in the up direction.

5. All "DOWN" landing calls are made when car is traveling in the down direction.
6. Uppermost and lowermost calls are answered as soon as they are reached without consideration of the car travel direction.

2.07 SERVICE CONTROL TYPE

A. Restricted Access Service Control:
   1. Landing Call Lock-out (Mechancial Mezzanine): Provide a key (Schlage Keyway) operated switch with key removable from "On" or "Off" position in landing control station that performs the following when activated:
      a. Restricts or permits landing call registration for that landing.

2.08 EMERGENCY POWER

A. Set-up elevator operation to run with building emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.

B. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.

C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

D. Provide operational control circuitry for adapting the change from normal to emergency power.

E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.09 MATERIALS

A. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.

B. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

C. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.

D. Tile Carpet Flooring: As specified in Section 09 6813 - Tile Carpeting.

E. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.10 CAR AND HOISTWAY ENTRANCES

A. Elevator:
   1. Car and Hoistway Entrances, First and Second Floors:
      a. Hoistway Fire Rating: 1 Hours.
      b. Elevator Door Fire Rating: 1 Hours.
      c. Framed Opening Finish and Material: Brushed stainless steel.
      d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
      e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
      f. Door Type: Single leaf.
      g. Door Operation: Center opening, single speed.
      h. Door Width: ___ inch.
      i. Door Height: 84 inch.
      j. Sills: Extruded aluminum.
   2. Car and Hoistway Entrances, Mechanical Loft:
      a. Hoistway Fire Rating: 1 Hours.
      b. Elevator Door Fire Rating: 1 Hours.
      c. Framed Opening Finish and Material: Alkyd enamel on steel.
      d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
      e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
      f. Door Type: Single leaf.
      g. Door Operation: Side opening, two speed.
      h. Door Width: 36 inch.

i. Door Height: 84 inch.

B. Sills/Thresholds: Configure to align with frame return and coordinate with floor finish.

C. Gasketing: Provide acoustic type gasketing at hoistway doors and frames to eliminate audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

2.11 CAR EQUIPMENT AND MATERIALS

A. Elevator Car:
1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
   a. Panel Material: Integral with front return; one per car.
   b. Car Floor Position Indicator: Above door with illuminating position indicators.
   c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
   d. Provide matching service cabinet integral with front return panel, with hinged door and keyed lock in each car.
   e. Provide following within service cabinet as part of car operating panel:
      1) Switch for each auxiliary operational control, keyed.
      2) Switches for fan, light, and inspection control.
      3) Emergency light.
      4) Telephone cabinet and hard-wired connection with hands-free telephone.
      5) Convenience outlet receptacle; 110 VAC, 15 amps.
2. Ventilation: Single speed fan with grille in ceiling.
3. Flooring: Carpeting.
4. Wall Base: Resilient base, 4 inch high.
5. Front Return Panel: Match material of car door.
6. Door Wall: Stainless steel, textured.
7. Side Walls: Stainless steel, textured.
8. Rear Wall: Stainless steel, textured.
9. Hand Rail: Stainless steel, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
   a. Stainless Steel Finish: No. 4 Brushed.
10. Ceiling:
   a. Canopy Ceiling: Stainless steel.
   b. Lighting: LED.

B. Car Accessories:
1. Certificate Frame: Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.
2. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
   a. Color: Tan.
   b. Provide at least 4 inch clearance from bottom of pad to finished floor.
   c. Pad Supports: Stainless steel studs, and mounted from ceiling frame.

2.12 FINISHES

A. Finish Paint for Metal Surfaces: Alkyd enamel, semi-gloss, color as selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway, pit, and machine room are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components, and comply with requirements of Section 01 5000 - Temporary Facilities and Controls.

B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories. Refer to Sections 26 0533.13 and 26 0583.

D. Install hydraulic piping between cylinder and pump unit.

E. Mount machines, motors, and pumps on vibration and acoustic isolators.
   1. Place on structural supports and bearing plates.
   2. Securely fasten to building supports.
   3. Prevent lateral displacement.

F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.

H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.

L. Adjust equipment for smooth and quiet operation.

M. Install wall protection pads at the time of installation to remain in place until the Owner requests removal.

3.04 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI-1 will be performed at their discretion.
   1. Schedule tests with agencies and notify Owner and Architect.
   2. Obtain permits as required to perform tests.
   3. Document regulatory agency tests and inspections in accordance with requirements.
   4. Perform tests required by regulatory agencies.
   5. Furnish test and approval certificates issued by authorities having jurisdiction.

3.06 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional 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. Briefly describe function, operation, cleaning and maintenance of each component.

3.09 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.10 MAINTENANCE

A. Refer to Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to initial maintenance service.

B. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion.

C. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.

D. Examine system components bi-monthly.

E. Include systematic examination, adjustment, and lubrication of elevator equipment.

F. Perform work without removing cars from use during peak traffic periods.

G. Provide emergency call back service during regular working hours throughout period of this maintenance contract.

H. Maintain an adequate stock of parts for replacement or emergency purposes, and have personnel available to ensure the fulfillment of this maintenance contract without unreasonable loss of time.

END OF SECTION 14 2400

SECTION 21 0500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SUMMARY

A. The intent of Division 21, Fire Suppression Specifications, and the accompanying Drawings is to be a reference for preliminary locations and routing of fire protection system components. Not all components required for a complete system are shown, including but not limited to standpipes, hose connections, sprinkler heads, fire protection zones, air compressors, dry valves, piping, appurtenances, connections, etc.

B. Provide a complete and workable facility with complete systems that comply with the requirements of the state codes, local codes, fire marshal, owner's insurance underwriter, and any other authority having jurisdiction.

C. Division 21, Fire Suppression Specifications and the accompanying Drawings are complimentary and what is called for by one as binding as if called for by both. Items shown on the Drawings are not necessarily included in the Specifications and vice versa.

D. Imperative language is frequently used in Division 21, Fire Suppression Specifications. Except as otherwise specified, requirements expressed imperatively are to be performed by the Contractor.

E. Piping and sprinkler head locations meet the Architectural design intent for the building in addition to applicable code. The right is reserved to make any reasonable changes in sprinkler head location prior to roughing-in, without cost impact. Deviation from the general routing piping mains, standpipes, or other routing shown must be approved by the architect prior to installation. If additional space is required for fire protection system components, Architect to make a formal request.

F. Associated power required for fire protection system components such as heat are the responsibility of the design-build contractor. Request approval from the electrical engineer to use spaces in electrical panels provided at no additional cost.

G. Furnish piping, pipe fittings, valves, gauges, and incidental related items as required for complete systems. Identify valves, piping and equipment components to indicate their function and system served.

H. The General and Supplemental Conditions apply to this Division, including but not limited to:
   1. Drawings and specifications.
   2. Public ordinances, permits.
   3. Include payments and fees required by governing authorities for work of this Division.

I. Division 01, General Requirements, applies to this Division.

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 21, Fire Suppression

C. Section 21 1000, Water Based Fire Suppression Systems

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Products and equipment prohibited from containing pentabrominated, octabrominated and decabrominated diphenyl ethers. Where products or equipment's within this specification contain these banned substances, provide complying products and equipment's from approved manufacturers with equal performance characteristics.
   2. General:
      a. Conform Work and materials to requirements of the local and State codes, fire marshal, the owner's insurance underwriter, and any other authority having jurisdiction; and Federal, State and other applicable laws and regulations.

3. Contractor responsible for obtaining and payment for permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.
4. Fire protection system designs must bear the stamp and seal of the registered Professional Engineer who prepared the documents. The Engineer's stamp certifies that the work was done under the Engineer's supervision and control. Certification from NICET technicians, or other contractors, cannot replace the certification by the Engineer. Verify/coordinate with local building department for their specific requirements.

B. New materials and Equipment:
1. Good work quality, free of faults and defects and in conformance with the Contract Documents.

C. Apparatus: Build and install to deliver full rated capacity at the efficiency for which it was designed.

D. The entire system and apparatus operate at full capacity without objectionable noise or vibration.

E. Materials and Equipment:
1. Each piece of equipment furnished meet detailed requirements of the Drawings and Specifications and suitable for the installation shown. Equipment not meeting requirements will not be acceptable, even though specified by name along with other manufacturers.
2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
3. Furnish materials and equipment of size, make, type, and quality herein specified.
4. Equipment scheduled by performance or model number considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the contractor is responsible for changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements, or any other differences which impact the project.

F. Workmanship:
1. General: Install materials in a neat and professional manner.
2. Manufacturer's Instructions:
   a. Follow manufacturer's directions where they cover points not specifically indicated. If they are in conflict with the Drawings and Division 21, Fire Suppression Specifications, obtain clarification before starting work.

G. Cutting and Patching:
1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.
2. Make additional openings required in building construction by drilling or cutting. Use of jackhammer is specifically prohibited.
3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
4. Do not pierce beams or columns without permission of Architect and then only as directed.
5. New or existing work cut or damaged restored to its original condition. Where alterations disturb lawns, paving, walks, etc., the surfaces repaired, refinished, and left in condition existing prior to commencement of work.

1.04 SUBMITTALS

A. Certified Shop Drawings:
   1. Drawings indicate the general layout of the piping and various items of equipment. Coordination with other trades and with field conditions will be required. For this purpose, prepare fire protection system layout Drawings showing locations and types of head or outlets, alarm valves and devices, pipe sizes and cutting lengths, test tees and valves, drain valves, and other related items. New drawings prepared by Contractor and not reproductions or tracings of Architect's Drawings. Overlay drawings with shop drawings of other trades and check for conflicts. Drawings the same size as Architect's Drawings with title block similar to the Drawings and identifying Architect's Drawing number or any reference drawings. Drawings fully dimensioned including both plan and elevation dimensions. Shop drawings cannot be used to make scope changes.
   2. Shop Drawings:
      a. Prepare in [two-dimensional] format.
      b. Include but are not limited to:
         1) Sprinkler head layout drawings overlaid with ceiling and floor plans.
         2) Sprinkler floor plans, including piping, equipment, and heads to a minimum of 1/4-inch equals 1-foot scale or same as plans, whichever is greater.
         3) Superplot plans of above ground work with a colored overlay of all trades including, but not limited to, HVAC piping, HVAC equipment, plumbing piping and equipment, sprinklers, lighting, lighting controls, cable tray, fire alarm devices, electrical power conduit, and ceiling system to a minimum of 1/2-inch equals 1-foot scale.
         4) Beam penetration drawings indicating beam penetrations meeting the requirements indicated on the floor plans and on the structural drawings to a minimum of 1/4-inch equals 1-foot scale.
         5) Slab penetration drawings of HVAC, plumbing, sprinklers, lighting and electrical to a minimum of 1/4-inch equals 1-foot scale.
         6) Fabrication drawings of radiant ceiling panels, architectural metal ceiling, including panel penetrations for lighting, sprinkler heads, fire alarm devices, and any other penetrations.
   3. Submit shop drawings for review prior to beginning fabrication. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.

B. Product Data:
   1. Submit product data for review on scheduled pieces of equipment, on equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures, and similar data. Manufacturer's abbreviations or codes are not acceptable
   2. Provide sample of each type of sprinkler head.
   3. Indicate equipment operating weights including bases and weight distribution at support points.
   4. In the case of equipment such as wiring devices, time switches, valves, etc., specified by specific catalog number, a statement of conformance will suffice.

C. Hydraulic Calculations:
   1. Submit hydraulic calculations specific to the installation.

D. Test Reports:
   1. Submit certificates of completion of tests and inspections.

E. Submission Requirements:
   1. Refer to Division 01, General Requirements for additional requirements related to submittals.
   2. Shop Drawings:
      a. Provide three sets of Drawings showing sprinkler head locations and layout coordinated with architectural ceiling details to the Architect for review prior to submitting Drawings to insurance underwriter and Fire Marshal.
      b. Provide six sets of Drawings and calculations to the Architect to be sent to the Owner's insurance underwriter for approval.
      c. Then submit six sets of approved Drawings to Architect for final review.
   3. Product Data:
      a. Submit electronic copies of shop drawings and product data for Work of Division 21 in PDF format with each item filed under a folder and labeled with its respective specification section number, article, paragraph, and mark, if applicable.
      b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
      c. Submit shop product data in a single submittal. Partial submittals will not be accepted. Re-submittals submitted after return of the original binder includes a tab similar to that originally submitted. Upon receipt of the returned re-submittals, insert them in the previously submitted.

F. Contractor Responsibilities:
   1. See that submittals are submitted at one time and are in proper order.
   2. Obtain approvals and permits from the AHJ.
   3. Ensure that equipment will fit in the space provided.
   4. Assure that deviations from Drawings and Specifications are specifically noted in the submittals. Failure to comply will void review automatically.

1.05 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNERS INSTRUCTIONS

A. Refer to Division 01, General Requirements for additional requirements.

B. Submit three bound copies of manufacturer's operation and maintenance instruction manuals and parts lists for each piece of equipment or item requiring servicing. Literature on 8-1/2-inch by 11-inch sheets or catalogs suitable for side binding. Submit data when the work is substantially complete, packaged separately, and clearly identified in durable 3-ring binder. Include name and contact information for location of source parts and service for each piece of equipment. Clearly mark and label in each submittal, the piece of equipment provided with the proper nameplate and model number identified. Provide wiring diagrams for electrically powered equipment.

C. Instruct Owner thoroughly in proper operation of equipment and systems, in accordance with manufacturer's instruction manuals. Operating instructions cover phases of control.

D. Furnish competent engineer knowledgeable in this building system for minimum of one 8-hour day to instruct Owner in operation and maintenance of systems and equipment. Keep a log of this instruction including dates, times, subjects, and those present and present such log when requested by Architect.

E. Provide fire pump as-constructed data, and installation, start-up and testing manuals.

1.06 AS-BUILT DRAWINGS

A. Provide 3D model and record drawings at the end of the project on USB storage device.

B. 3D model in the following format:
   1. Revit

C. Provide record drawings in hard copy and PDF format.
   1. Drawings include the following:
      a. Project specific title block.

b. Notations reflecting the as built conditions of any additions to or variations from the construction documents provided as part of the BIM coordination, RFIs, ASIs, Owner Changes, and Field Coordination.

1.07 PROJECT CONDITIONS

A. Existing Conditions: Prior to bidding, verify and become familiar with existing conditions by visiting the site, and include factors which may affect the execution of this Work. Include related costs in the initial bid proposal.

B. Coordinate exact requirements governed by actual job conditions. Check information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, City, and Utility Company.

1.08 WARRANTY

A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.

B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.

C. Correct warranty items promptly upon notification.

1.09 PROVISIONS FOR LARGE EQUIPMENT

A. Make provisions for the necessary openings in building to allow for admittance of equipment.

1.10 TEST REPORTS AND CERTIFICATES

A. Submit one copy of test reports and certificates specified herein to the Architect.

1.11 SUBSTITUTIONS

A. Submit any requests for product substitutions in accordance with the Instructions to Bidders and the General and Supplemental Conditions.

PART 2 PRODUCTS

2.01 ACCESS PANELS

A. Furnish under this Division as specified in another Division of work.

2.02 PIPE SLEEVES

A. Interior Wall and Floor Sleeves:
   1. 18 gauge galvanized steel or another pre-approved water tight system.

B. Interior Wall and Floor Sleeves (fire rated):
   1. Fire rated and water tight system approved by Authority Having Jurisdiction and Owners Insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.

C. Exterior Wall Sleeves:
   1. Cast Iron

D. On Grade Floor Sleeves:
   1. Same as exterior wall sleeves.

2.03 FLOOR, WALL AND CEILING PLATES

A. Furnish stamped split type plates as follows:
   1. Floor Plates:
      a. Cast brass, chromium plated.
   2. Wall and Ceiling Plates:
      a. Spun aluminum.

2.04 ELECTRICAL EQUIPMENT

A. General:
   1. Equipment and installed work as specified under Division 26, Electrical.

B. Motors:
   1. Furnish as integral part of driven equipment. Drip-proof induction type with ball bearings unless noted otherwise.
   2. Built to NEMA Standards for the service intended.
   3. Rated for the voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage.
   4. Manufacturers:
      a. Baldor
      b. Westinghouse
      c. General Electric
      d. Or approved equal.
   5. Where provided, refer to Equipment Schedules on the Drawings for motor horsepower, voltage, and phase.
   6. Refer to individual product sections for additional motor requirements.
   7. Built-in thermal overload protection, or be protected externally with separate thermal overload devices with low voltage release or lockout. Hermetically sealed motors have quick trip devices.

C. Starters:
   1. Provided under Division 26, Electrical, suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.

D. Equipment Wiring:
   1. Provide interconnecting wiring within or on a piece of fire suppression equipment with the equipment unless shown otherwise. This does not include the wiring of motors, starters and controllers provided under Division 26, Electrical.

E. Control Wiring:
   1. Provide control wiring for fire suppression equipment.

F. Codes:
   1. Electrical equipment and products to bear the UL as required by governing codes and ordinances.

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate fire protection piping and appurtenances with ducts, other piping, electrical conduit, and other equipment.

B. Conceal fire protection piping and equipment be concealed except in area without ceilings and as noted on the Drawings.

C. Locate piping, heads, and equipment where shown on Drawings.

3.02 GENERAL

A. Install fire protection systems to serve the entire building.

B. The drawings indicate approximate locations of piping, sprinkler zones, and types of systems. The drawings do not indicate the locations of sprinkler heads in ceiling areas. Locate sprinklers in the center of ceiling panels and symmetrically within rooms and down corridors, coordinated with and in pattern with lights and grilles. Deviations must be approved.

C. Locations of sprinkler heads, outlets, piping, and appurtenances are not shown in areas and therefore are to be installed in accord with code requirements.

D. Location of heads shown in ceiling areas may be changed if required by code requirements, but only after review by the Architect for new head locations for each specific instance.

3.03 SLEEVES

A. Interior Floor and Wall Sleeves:
   1. Provide sleeves large enough to provide clearances around pipe outside diameter as required by NFPA. Penetrations through mechanical room and fan room floors made watertight by packing with safing insulation and sealing with Tremco Dymeric Sealant or approved water tight system.

B. Sleeves through Rated Floors and Walls:
   1. Similar to interior sleeves except install fire-rated system approved by Authority Having Jurisdiction and Owner's Insurance Underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.

C. Exterior Wall Sleeves Below Grade:
   1. Large enough to allow for caulking and made watertight. Caulking from outside using link-seal modular wall and casing seal or lead and oakum. Secure sleeves against displacement.

D. On Grade Floor Sleeves:
   1. Same as below grade exterior wall sleeves, caulked from inside.

E. Exterior Wall Sleeves Above Grade:
   1. Similar to interior wall sleeves except caulk outside with Tremco Dymeric Sealant.

F. Layout work prior to concrete forming. Do cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.

G. Floor sleeves maintain a water barrier by providing a water tight seal or extend 1-inch above finished floor except through mechanical equipment room floors and shafts where sleeves extend 2-inches above finished floor level. Sleeves through roof extend 8-inches above roof. Wall sleeves flush with face of wall unless otherwise indicated. Sleeves through planters extend 8-inches above planter base.

H. Do not support pipes by resting pipe clamps on floor sleeves. Provide supplementary members so pipes are floor supported.

I. Special sleeves detailed on the Drawings take precedence over this section.

3.04 FLOOR, WALL AND CEILING PLATES

A. Install on piping passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates completely cover opening around pipe and duct.

B. Secure wall and ceiling plates to pipe or structure.

C. Plates not required in mechanical rooms or unfinished spaces.

3.05 CLEANING

A. General:
   1. Clean equipment and piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.

B. Painted Surfaces:
   1. Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

C. Additional requirements are specified under specific Sections of this Division.

3.06 EQUIPMENT PROTECTION

A. Keep pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, equipment, and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated equipment, or apparatus to original conditions or replace at no cost to the Owner.

B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.

C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.07 ACCESSIBILITY

A. General:
   1. Locate valves, indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.

B. Gauges:
   1. Install gauges so as to be easily read from the floors, platforms, and walkways.

3.08 PAINTING

A. General:
   1. Coordinate painting of fire suppression equipment and items with products and methods in conformance with the appropriate Division of Work, Painting.

B. Equipment Rooms and Finished Areas:
   1. Hangers
   2. Miscellaneous Iron Work
   3. Structural Steel Stands
   4. Tanks
   5. Equipment Bases:
      a. Paint one coat of black enamel.
   6. Steel Valve Bodies and Bonnets:
      a. One coat of black enamel.
   7. Equipment:
      a. One coat of red machinery enamel. Do not paint nameplates.
   8. Sprinkler Heads:
      a. Not painted.

C. Concealed Spaces (above ceilings, not visible):
   1. Hangers, Miscellaneous Iron Work, Valve Bodies, and Bonnets: Not painted.

D. Sprinkler Piping:
   1. Concealed from View: Not painted.
   2. Exposed to View: Paint pipe and hangers exposed to view, including in equipment spaces, with one coat approved rust inhibiting primer. Final finish coat as specified in conformance with the appropriate Division of Work, Painting.
   3. Exterior: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel. Final finish coat as specified in conformance with the appropriate Division of Work, Painting.
   4. Alarm Bell: Factory paint with two coats of red enamel.

3.09 ADJUSTING AND CLEANING

A. General:
   1. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
   2. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.

B. Piping:
   1. Clean interior of piping before installation.
   2. Flush sediment out of piping systems.

3.10 ELECTRICAL EQUIPMENT

A. Fire Suppression systems not to pass over switchboards or electrical panelboards. Where conflicts exist, bring to attention of Architect.

END OF SECTION

SECTION 21 1000

WATER BASED FIRE SUPPRESSION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes Design-Build work and the following:
   1. Electric Alarm Bell
   2. Fire Department Connection Sprinkler Heads
   3. Flow Switch
   4. Tamper Switch
   5. Fire Department Test Station
   6. Valves
   7. Ductile Iron Water Pipe
   8. Black Steel Pipe
   9. Flanged Joints
   10. Mechanical Pipe Couplings and Fittings
   11. Expansion Loops/Seismic Expansion Joints
   12. Pressure Gauges
   13. Utility Markers
   14. Valve Identification
   15. Piping Markers
   16. Equipment Identification

1.02 RELATED SECTIONS

1. Division 01, General Requirements
2. Division 21, Fire Suppression

1.03 QUALITY ASSURANCE

A. Provide a complete automatic fire sprinkler/combination standpipe system.
   1. Grooved joint couplings, fittings, valves, and specialties products of a single manufacturer. Grooving tools of the same manufacturer as the grooved components.
   2. Castings used for coupling housings, fittings, valve bodies, etc., date stamped for quality assurance and traceability.

B. Regulatory Requirements:
   1. Sprinkler system to comply with NFPA 13 and local Fire Marshal requirements.
   2. Refer to Section 21 0500, Common Work Results for Fire Suppression for additional requirements.

C. Hydraulically Calculated Sprinkler System: Sprinkler system to be hydraulically calculated grid system designed to provide:
   1. Light Hazard Occupancies: 0.10 GPM/Ft2 density at most remote 1500 SF for public areas, living spaces, or designated by the local fire marshal with an excess of 10 psi additional pressure requirements incorporated into the design over specified pressure requirements.
   2. Ordinary Hazard Occupancies Group 1: 0.15 GPM/Ft2 density at most remote 1500 SF for mechanical rooms, kitchen, and parking areas, or designated by the local fire marshal with an excess of 10 psi additional pressure requirements incorporated into the design over specified pressure requirements.
   3. Ordinary Hazard Occupancies Group 2: 0.20 GPM/Ft2 density at most remote 1500 SF for mechanical rooms, kitchen, and parking areas, or designated by the local fire marshal with an excess of 10 psi additional pressure requirements incorporated into the design over specified pressure requirements.

D. NFPA 13 (without the use of exceptions found in NFPA 13 systems minimum guideline) used for the location, sizing, and installation of piping and sprinkler systems unless local fire marshal or owner's insurance underwriter requirements are more stringent. Exceptions must be approved by the Engineer prior to usage.

E. Water Service Pressure Basis of Design:
   1. Coordination was done to determine fire service water pressure used to develop the fire sprinkler system design information included herein.
   2. Fire Protection contractor to obtain current flow test information prior to starting their design of the fire sprinkler system.

F. Automatic sprinklers within elevator hoistways and machine rooms complies with ANSI A17.1-102.2 (c) 4 requirements.

1.04 SUBMITTALS

A. Provide submittal in accordance with Section 21 0500, Common Work Results for Fire Suppression.

B. Sprinklers referred to on shop drawings and identified by the listed manufacturer's style or series designation. Trade names and abbreviations are not permitted.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Electric Alarm Bell:
   1. Potter Electric Signal Company, Model PBA1208
   2. Double Interlocked [Freezer Applications]

B. Fire Department Connection:
   1. Stanchion Type:
      a. Potter-Roemer Model 5763
   2. Flush Type:
      a. Potter-Roemer Figure 5022
      b. Standard

C. Sprinkler Heads:
   1. Viking
   2. Victaulic
   3. Reliable Automatic Sprinkler
   4. Tyco Fire Products

D. Flow Switch:
   1. Potter Electric Model VSR-F
   2. System Sensor Model WFD

E. Tamper Switch:
   1. Potter Electric Signal Company Model PCVS.

F. Fire Department Test Station:
   1. Victaulic Style 720
   2. Viking

G. Valves:
   1. Where only one manufacturer's model is listed, equivalent products by those specified below, or equal, are acceptable.
   2. Use only one manufacturer.
   3. Gate, Swing Check:
      a. Jenkins
      b. Victaulic
      c. Crane
      d. Hammond
      e. NIBCO

f. Kennedy
4. Silent Check:
a. Jenkins
b. Victaulic
c. Mueller
d. Metraflex
e. Gustin-Bacon
5. Butterfly:
a. Jenkins
b. NIBCO
c. Keystone
d. Victaulic
e. Gustin-Bacon
6. Specialty:
a. NIBCO
b. Conbraco
c. Victaulic

H. Mechanical Pipe Couplings and Fittings:
1. Victaulic
2. Gruvlok

I. Pressure Gauges:
1. Marsh
2. Ashcroft
3. Weiss
4. Trerice
5. Weksler
6. Tel-Tru

J. Piping Markers:
1. W.H. Brady
2. Seton
3. Marking Systems, Inc. (MSI).

2.02 ELECTRIC ALARM BELL

A. 8-inch diameter, 120V, 1-phase, red finish, UL and FM approved, labeled Fire Alarm.

2.03 FIRE DEPARTMENT CONNECTION (FDC)

A. Description:
1. Provide on the system riser in accordance with NFPA 13, Standard for Installation of Sprinkler Systems.
2. Brass body with an integral clapper assembly to separate flow between inlets.
3. Install in an area accessible for the first response unit.
4. UL listed and FM approved for fire protection use.
5. At low point near each fire department connection, provide a 90-degree elbow with drain connection to allow for localized system drainage to prevent freezing.
6. Victaulic FireLock 10-DR.

B. Flush Type: Polished chrome plated flush fire department inlet connection with clappers, lettered (Auto. Spkr., OR Auto. Spkr. Standpipe) 4-inch by 2-1/2-inch by 2-1/2-inch complete with plugs and chains.

2.04 SPRINKLER HEADS

A. General:
1. One manufacturer throughout building. Mixing of sprinkler brands is not permitted.
2. Brass frame construction with a coated metal-to-metal seating mechanism. Sprinklers utilizing non-metal parts in the sealing portion of the sprinkler are strictly prohibited.

3. Quick response frangible bulb type fusible element with a temperature rating of 155 degrees or 200 degrees F or a fast response metal type fusible element with a temperature rating of 165 degrees or 212 degrees F.
4. 1/2-inch NPT, a standard orifice, and a 5.6 nominal K Factor.
5. UL listed and FM Approved for working water pressures up to 175 psi. Sprinkler heads in dry and pre-action type systems installed per NFPA 13.
6. Heads, UL approved for application and installation.

B. Provide high temperature, 212 degrees F heads for mechanical rooms, areas below skylights, dishwashing and other areas which have high heat producing equipment to prevent accidental trip page.

C. Sprinklers Installed in Finished Ceilings:
1. Quick response, recessed, bulb type, [white] finish, 165 degrees F unless required otherwise.

D. Sprinklers Installed in Unfinished Ceiling Areas (or Above Finished Ceilings Where Required):
1. Pendant or up-right fusible solder type, rough bronze finish, and adequate temperature for the hazard.

E. Sprinklers Installed in Exterior Perimeter Areas:
1. Quick response, horizontal dry sidewall sprinkler, fusible solder type, polished chrome finish.
2. Quick response, concealed pendant with [chrome] [white] drop-off cover plate, gasket for dust free environments, rough bronze finish, 155 degrees F unless required otherwise.
3. Institutional sidewall, quick response, tamperproof construction, stainless steel.

F. Sprinklers Installed in Exterior Covered Areas:
1. Quick response, dry pendant fusible solder type, chrome finish, 165 degrees F unless required otherwise.

G. Life Safety Type Sprinkler Heads (Window Wash to Maintain Ratings at Glazed Openings at Enclosed Stairs):
1. Quick response, chrome finish, horizontal sidewall or pendant vertical sidewall, Central Model WS Window Sprinkler, or similar listed sprinkler for this application.

H. Sprinkler Heads, Corrosion Resistant:
1. Pendant type, rough bronze finish, 165 degrees F, with factory applied corrosion resistant coating.

I. Flexible Stainless Steel Hose:
1. UL rated, FM approved stainless steel hose assembly for individual sprinkler connections, Victaulic Vic-Flex.
2. Drop includes a UL approved braided hose with a bend radius to 2-inch to allow for proper installation in confined spaces.
3. Provide union joints for ease of installation.
4. Attach flexible drop to the ceiling grid using a one-piece open gate bracket. The bracket allows installation before the ceiling tile is in place.
5. The braided drop system is UL listed and FM Approved for sprinkler services to 175 psi (1206 kPa).

J. Flexible Dry Stainless Steel Hose:
1. UL rated approved stainless steel hose assembly for individual sprinkler connections, Victaulic VicFlex Dry Sprinkler Style VS1, 5.6 K, Quick and Standard Response.
2. Drop includes a UL approved braided hose with a minimum bend radius to 2-inch to allow for proper installation in confined spaces, with a maximum number of 4, 90 degree bends.
3. Must be installed according to current, applicable NFPA (13, 13D, 13R, ect…) or equivalent standards. These can be installed in wet, dry, or preaction actuated systems.
4. Follow the current manufactures instructions/assembly for proper installation. Installations must also meet provisions of the local codes, local Authority Having Jurisdiction, as applicable.

5. The system designer must verify the suitability of the intended fluid media with the 300-Series stainless steel flexible hose.
6. The braided dry drop system is UL listed for sprinkler services up to 175 psi (1206 kPa).

2.05 FLOW SWITCH

A. Description:
   1. UL listed electric flow switch with retard.
   2. Provide required accessories.

B. Single pole type with normally open and normally closed contacts. Location as shown. Provide rewired related trimmings. Provide one set of contacts for use by the Fire Alarm Contractor. Coordinate with pipe size.

2.06 TAMPER SWITCH

A. Description:
   1. Each sprinkler system control valve equipped with a tamper switch listed by Underwriters Laboratories for the particular location and type of valve supervised.
   2. Initiates a supervisory signal upon a maximum of two complete turns of a valve wheel or closure of ten percent, whichever is less.
   3. Provide number of poles to coordinate with the fire alarm system manufacturer.

2.07 FIRE DEPARTMENT TEST STATION

A. One piece, compact, floor test module for standard alarm test loop, threaded.

2.08 VALVES

A. Gate, butterfly, and check valves meet current MSS standards.

B. Bronze gate and check valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

C. Full lug and grooved butterfly valves suitable for bi-directional dead end service at full rated pressure without use or need of a downstream flange.

D. Valves in Insulated Piping: Valves have 2-inch stem extensions and the following features:

E. Gate Valves: Rising stem type.

F. Butterfly Valves: Extended necks.

G. Valve ends may be threaded, flanged, soldered, or grooved as applicable to piping system.

H. Provide ball drip drains, test orifices, and other related items as required to provide a complete fire protection system.

I. Gate Valves:
   1. Bronze Gate: Bronze body, bronze screwed bonnet, bronze solid wedge, OS&Y pattern, rising stem, pre-grooved stem for supervisory switch mounting, 175 psi CWP, UL listed, FM approved; NIBCO T-104.
   2. Iron Gate: Iron body, bronze trim, OS&Y pattern, solid wedge, pre-grooved stem for supervisory switch mounting, 175 psi CWP, UL listed, FM approved; NIBCO F-607-OTS.
   3. Iron Gate, High Pressure: Iron body, bronze trim, flanged OS&Y pattern, solid wedge, FM approved for 300 psi, UL listed 350 psi; NIBCO F-697-0.

J. Check Valves:
   1. Horizontal Bronze Swing Check:
      a. Bronze body, bronze-mounted, TFE disc, 150 psi SWP, 300 psi CWP; NIBCO T-443-Y, NIBCO S-433-Y.
      b. Check valves in main riser path FM approved.
   2. Horizontal Bronze Swing Check, High Pressure:
      a. Bronze body, bronze-mounted, regrinding bronze disc, 300 psi SWP, 1000 psi CWP; NIBCO T473-B.
      b. Check valves in main riser path FM approved.

3. Horizontal Iron Swing Check:
    a. Iron body, bronze-mounted, regrinding bronze disc and seat ring, 200 psi CWP; NIBCO F-918-B.
    b. Check valves in main riser path FM approved.
4. Vertical and Silent Check Valves:
    a. Iron body, stainless steel spring, wafer type, globe style, 200 psi CWP; NIBCO 910-B.
    b. Check valves in main riser path, FM approved.
5. Vertical and Silent Check Valves, High Pressure:
    a. Iron body, stainless steel spring, wafer type, globe style, 400 psi CWP; NIBCO W-960-B, NIBCO F-960-B.
    b. Check valves in main riser path, FM approved.

K. Butterfly Valves:
1. Iron Butterfly:
    a. Ductile iron body, aluminum-bronze disc and one-piece stainless steel shaft, copper bushing, fasteners and pins not used to attach stem to disc, gear operator, stem neck length to accommodate insulation where applicable, EPDM liner or disc, 200 psi CWP; NIBCO LD 2000 (lug style), NIBCO GD-4765 (grooved ends).
    b. Butterfly valves in main riser path, FM approved.
2. Iron Butterfly, High Pressure: Ductile iron body, ductile iron disc and one-piece stainless steel shaft, copper bushings, fasteners and pins not used to attach stem to disc, with lever handle and locking feature on valves 6-inches and smaller, gear operator, EPDM liner or disc, 300 psi CWP, integral supervisory switch, UL listed, FM approved; NIBCO GD-4765.

L. Specialty Valves:
1. Drain Valves: Bronze ball valve, garden hose end, cap and chain 3/4-inch size, bronze cast body, chrome-plated full port ball, with handle, Teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP; NIBCO T-585-70-HC.
2. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch; Conbraco 41 series, or equal.

2.09 DUCTILE IRON WATER PIPE

A. Pipe: Ductile iron pipe conforming to ANSI A21.51.

B. Fittings:
1. Below grade, Class 150 Boltite mechanical joint type complete with gaskets, bolts, and nuts, or Tyton for joints employing a single gasket for the joint seal with bell-and-spigot pipe.
2. Above grade, mechanical couplings and fittings as specified herein.
3. Provide interior pipe coating per ANSI Regulation listed.

C. Service: Below grade incoming fire protection main.

2.10 BLACK STEEL PIPE

A. General:
1. UL listed and FM approved for fire protection use.
2. Fittings and joints must be UL listed with pipe chosen for use.
3. Listing restrictions and installation procedures per NFPA 13 and state and local authorities for fire protection use.
4. Pipe/fittings must be hot-dipped galvanized in accordance with ASTM A53 for dry pipe sprinkler systems.

B. Pipe: ASTM A135 or A53.
1. Fire Protection:
    a. Schedule 10 or Schedule 40 in sizes up to 5 inches.
    b. 0.134-inch wall thickness for 6-inch.
    c. 0.188-inch wall thickness for 8-inch and 10-inch.
    d. 0.330-inch wall thickness for 12-inch.

C. Fittings: Roll grooved ends with mechanical couplings as specified.

D. Service Above Grade: Fire protection system only for sizes listed, as approved by NFPA 13.

2.11 FLANGED JOINTS

A. Flanged Joints:
   1. Cast iron or steel for screwed piping and forged steel welding neck for welded line sizes.
   2. Pressure rating and drilling matches the apparatus, valve, or fitting to which they are attached.
   3. Flanges in accordance with ANSI B16.1; 150 lb. for system pressures to 150 psig; 300 pounds for system pressures 150 psig to 400 psig.
   4. Gaskets 1/16-inch thick, Cranite, or equal, ring type, coated with graphite and oil to facilitate making a tight joint.
   5. Make joint using American Standard hexagon head bolts, lock washers, and nuts (per ASTM A307 GR.B) for service pressures to 150 psig; alloy steel stud bolts, lock washer, and American Standard hexagon head nuts (per ASTM A307 GR.B) for service pressures 150 psig to 400 psig. Use length of bolt required for full nut engagement.
   6. Provide electro-cad plated bolts and nuts.

2.12 MECHANICAL PIPE COUPLINGS AND FITTINGS

A. Couplings and Fittings:
   1. Coupling housing to be zero flex rigid type coupling with angled bolt pad design. Couplings fully installed at visual pad-to-pad offset contact. Couplings that require gapping of bolt pads or specific torque ratings for proper installation are not permitted. Installation-Ready, for direct stab installation without field disassembly. Similar to Victaulic Type 009N.
   2. Flexible couplings to be used only when expansion contraction, deflection or noise and vibration is to be dampened. Flexible Coupling to be similar to Victaulic Installation-Ready Type 005.Coupling gasket similar to Victaulic's Grade E molded synthetic rubber per ASTM D-2000.
   3. Coupling bolts oval neck track head type with hexagonal heavy nuts per ASTM A-449 and A-183.

2.13 EXPANSION LOOPS / SEISMIC EXPANSION JOINTS

A. Flexible stainless steel hose and braid connector.

B. Connector accepts differential support displacement without damaging pipe, equipment connections, or support connections.

C. Materials of construction and pressure ratings appropriate for the application,

D. UL listed and FM approved for fire protection use. Listing restrictions and installation procedures per NFPA 13 and state and local authorities for fire protection use.

2.14 PRESSURE GAUGES

A. Description: 4-1/2-inch dial, molded black polypropylene turret case.

B. Range:

SYSTEM	PRESSURE	GRADUATIONS
Fire Protection	0-160 psi	1 psi
*Provide compound gauge where shown on inlet side of fire pump on open piping systems (30-inch 15 psi). Other ranges may be listed on Drawings in which case they take precedence.		

2.15 UTILITY MARKERS

A. Provide plastic tape utility markers over buried piping. Provide identification on tape.

B. Material to be Brady Identoline plastic tape, 6-inch, Seton, or as approved.

2.16 VALVE IDENTIFICATION

A. Valve Tags:
   1. General:
      a. Identify valves with metal tags or plastic signs, legends to be stamped or embossed.
      b. Indicate the function of the valve and its normal operating position, and area served; i.e.

3RD FL	(Area Served)
ISOLATION	(Valve Function)
NO	(Normal Operation Position)

   2. Size: Valve tags 2-inch diameter with 1/4-inch high letters.
   3. Material: Use 0.050 or 0.064-inch brass tags.
   4. Control Valves:
      a. Use 1/16-inch thick laminated 3-ply plastic, center ply white, outer ply red, lamicoid, or equal.
      b. Form letters by exposing center ply.

B. Valve Tag Directory: Include the following:
   1. Tag Number
   2. Location
   3. Exposed or Concealed
   4. Area Served
   5. Valve Size
   6. Valve Manufacturer
   7. Valve Model Number
   8. Normal Operating Position of Valve

2.17 PIPING MARKERS

A. Label pipes with all-vinyl, self-sticking labels or letters.

B. Pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4 to 2-inch outside diameter, 3/4-inch letters; above 2-inches outside diameter, 2-inch letters.

C. Identify and color code as follows with white directional arrows.

SERVICE	PIPE MARKER	BACKGROUND COLOR
SPRINKLER WATER	FIRE PROTECTION WATER	RED
AIR, COMPRESSED	*COMPRESSED AIR*	GREEN

2.18 EQUIPMENT IDENTIFICATION

A. Nameplates:
   1. Tag pumps, and miscellaneous equipment with engraved nameplates.
   2. 1/16-inch thick, 3-inch by 5-inch laminated 3-ply plastic, center ply white, outer ply black.
   3. Form letters by exposing center ply.
   4. Identify unit with code number as shown on Drawings and area served.

B. Equipment Nameplate Directory:
   1. List pumps, compressors and other equipment nameplates.
   2. Include Owner and Contractor furnished equipment.
   3. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
   1. Provide seismic hangers as required by code.
   2. Provide tamper switches on sprinkler system isolation valves. Provide flow switches for sprinkler zones. See Drawings for locations.

3. A corrosion-resistant metal placard provided on riser indicating location number of sprinklers, design criteria, water demand, and date of installation.
4. Install fire sprinklers in exhaust ductwork from grease hood per NFPA 13. Provide access doors for sprinkler access per NFPA 96 and IBC. Provide access doors at a maximum of 10-feet on center in horizontal run. Provide a dry pendant sprinkler head at top of ductwork to prevent freezing.
5. Provide sprinkler systems in lab ductwork as required by code.
6. Provide fire sprinkler guards on exposed sprinklers in areas subject to damage.
7. Quick response sprinklers listed for installation in an Ordinary Hazard occupancy when installed in an Ordinary Hazard occupancy.

B. Flexible Sprinkler Wet and Dry Head Drop:
1. Install per manufacturer's installation requirements.
2. Coordinate head location with other trades to assure space is available to maintain proper radius requirements.
3. Provide flexible sprinkler drops of appropriate length as conditions require.
4. Provide flexible sprinkler drops at sprinkler heads located in suspended, dropped, or acoustical ceilings. In hard lid ceiling areas, provide flexible heads at Contractor's option.

C. Sprinklers in Elevator Hoistways and Machine Rooms:
1. Reference Division 26, Electrical for heat detectors provided to disconnect mainline power of elevator prior to application of water from the sprinklers.
2. A shutoff valve with tamper switch will be provided for each branch service serving these spaces and located in an accessible location outside these spaces.

D. Sprinklers at Glazed Openings:
1. Glazed opening will be protected on both sides of glass by listed quick response Life Safety Type sprinkler heads designated to wet entire surface of glass. Sprinklers spaced 6-feet apart, 8- to 12-inches from the glass, or as required per sprinkler manufacturer's listed installation instructions.

E. Sprinklers above finished ceilings: Include heads above finished ceilings if structure is combustible, or if steel beams are not provided with spray-on fire proofing.

F. Electrical: Electrical work to comply with Division 26, Electrical.

G. Fire Service: Connect to sprinkler line where it enters the building.

H. Standpipe hose connections:
1. Provide in locations indicated and as required by code.
2. Confirm with the code official for hose connections that are at their discretion.
3. Coordinate exact installation location of with the architect and code official.

I. Hangers and Supports:
1. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
2. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
3. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

J. Pressure Gauges:
1. Provide gauges where specified, shown on Drawings, or required by code.
2. Install additional gauges as required and as recommended by equipment manufacturer or their representative.
3. Locate gauges so that they may be conveniently read at eye level or easily viewed and read from the floor or from the most likely viewing area.
4. Install instruments over 6-1/2-feet above floor, to be viewed from the floor, with face at 30 degrees to horizontal.
5. Provide instrument gauge cock at inlets.

K. Valves:
   1. Provide valves at connections to equipment where shown or required for equipment isolation.
   2. Install valves accessible and same size as connected piping.
   3. Provide separate support for valves where necessary.
   4. Provide drain valves in low points in the piping system, and at equipment, as required by code, and as indicated.
   5. Fire Suppression Service:
      a. In piping 2-inches and smaller; bronze gate valve, bronze swing check valve, vertical check valve.
      b. In piping 2-1/2-inches and larger; iron gate valve, iron swing check valve, vertical check valve.
      c. UL approved butterfly valves.
      d. Silent check valves on pump discharge.
   6. Provide gauge cocks for pressure gauges.

L. Piping Preparation:
   1. Measurements, Lines and Levels:
      a. Check dimension at the building site and establish lines and levels for work specified in this Section.
      b. Establish inverts, slopes, and elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with Drawings and Specifications.
      c. Use established grid and area lines for locating trenches in relation to building and boundaries.

M. Excavation and Backfill:
   1. General:
      a. Perform necessary excavation and backfill required for the installation of fire suppression work in accord with Division 02, Existing Conditions.
      b. Repair pipelines or other work damaged during excavation and backfilling.
   2. Excavation:
      a. Excavate trenches to the necessary depth and width, removing rocks, roots, and stumps.
      b. Include additional excavation to facilitate utility crossovers, additional offsets, etc.
      c. Excavation material is unclassified.
      d. Width of trench adequate for proper installation of piping. Widen if not wide enough for a proper installation.
   3. Bedding:
      a. Cast iron, steel, and copper piping fully bedded on sand.
      b. Place a minimum 4-inch deep layer on the leveled trench bottom for this purpose.
      c. Remove the sand to the necessary depth for piping bells and couplings to maintain contact of the pipe on the sand for its entire length.
      d. Lay other piping on a smooth level trench bottom so that contact is made for its entire length.
   4. Backfill:
      a. Place in layers not exceeding 8 inches deep, and compact to 95percent of standard proctor maximum density at optimum moisture content. Earth backfill free of rocks over 2 inches in diameter and foreign matter. Disposal of excess material as directed.
      b. Interior: Backfill under interior slabs bank sand or pea gravel.
      c. Exterior:
         1) Excavated material may be used outside of buildings
         2) First 4-inches of sand and final 12-inch layer of course soil.

N. Piping:
   1. Hold piping as tight to structure as possible. In general, run piping in areas without ceilings parallel to building elements in a neat, professional manner.
   2. Pipe inspector test connections to exterior and discharge as approved by local applicable governing authorities.
   3. Provide test tees as required.
   4. Install unions in non-flanged piping connections to apparatus and adjacent to screwed control valves, and appurtenances requiring removal for servicing so located that piping may be disconnected without disturbing the general system.
   5. Mechanical Couplings:
      a. On systems using galvanized pipe and fittings, galvanize fittings at factory.
      b. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with approved lubricant.
      c. Pipe grooving in accordance with manufacturer's specifications contained in latest published literature.
   6. Install piping as to drain per NFPA 13.
   7. Support piping independently at apparatus so that its weight not carried by the equipment.
   8. Utility Marking:
      a. Installed over the entire length of the underground piping utilities. Install plastic tape along both sides and the center line of the trenches at the elevation of approximately 12-inches above the top of utility.
   9. Underground Water System:
      a. Prior to testing pipe provide concrete thrust blocks at changes in direction.
      b. Block size as required for types of fittings involved.

O. Drain Piping:
   1. Pitch drain piping 1/2-inch per 10-feet minimum; no traps allowed.
   2. Discharge drain piping to outside with suitable splash plate to a location as approved by the architect.

P. Piping Joints:
   1. Join pipe and fittings using methods and materials recommended by manufacturer in conformance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc. done with proper tools and equipment. Hacksaw pipe cutting prohibited. Peening of welds to stop leaks not permitted.
   2. Grooved Joints:
      a. Install in accordance with the manufacturer's latest published installation instructions.
      b. Clean pipe ends free from indentations, projections and roll marks in the area from pipe end to (and including) groove.
      c. Gasket manufactured by the coupling manufacturer and verified as suitable for the intended service.
      d. Periodically visit the job site and review installation to ensure best practices in grooved joint installation are being followed.
      e. Remove and replace any improperly installed products.
   3. No couplings installed in floor or wall sleeves.
   4. Steel Piping:
      a. Screwed Joints:
         1) Pipes cut evenly with pipe cutter reamed to full inside diameter with burrs and cuttings removed.
         2) Joints made up with suitable lubricant or Teflon tape applied to male threads only, leaving two threads bare.
         3) Joints tightened so that not more than two threads are left showing.
         4) Junctions between galvanized steel waste pipe and bell of cast iron pipe made with tapped spigot or half coupling on steel pipe to form spigot end and caulked.

b. Flanged Joints:
1) Pressure rating of flanges match valve or fitting joined.
2) Coat joint gaskets with graphite and oil.

5. Welded Joints:
a. Preparation for Welding: Bevel piping on both ends before welding:
1) Use following weld spacing on buttwelds:

NOMINAL PIPE WALL THICKNESS	SPACING	BEVEL
1/4-inch or less	1/8-inch	37-1/2
Over 1/4-inch, less than 3/4-inch	3/16-inch	27-1/2

2) Before welding, remove corrosion products and foreign material from surfaces.
b. Welded Joints:
1) Use arc-welding process using certified welders. Port openings of fittings must match the inside diameter of the pipe to which they are welded. Use full radius welding elbows for turns, use welding tees for tees. Use reducing fittings for size reduction. Weldolets may be used for branches up through one-half the pipe size of the main to which they are attached. Nipples are not allowed.
c. Welding Operation:
1) After deposition, clean each layer of weld metal to remove slag and scale by wire brushing or grinding. Chip where necessary to prepare for proper deposition of next layer.
2) Weld reinforcement no less than 1/16-inch not more than 1/8-inch above normal surface of jointed sections. Reinforcement crowned at center and taper on each side to surfaces being joined. Exposed surface of weld present professional appearance and be free of depressions below surface of jointed members.
3) Do not weld when temperature of base metal is lower than 0 degrees F. Material to be welded during freezing temperatures made warm and dry before welding is started. Metal warm to the hand or approximately 60 degrees F.

6. Ductile Iron Pipe: Install joints per manufacturer's written instructions.

Q. Expansion Joints and Compensators:
1. Install in piping risers in wood structures to compensate for 1/2-inch of shrinkage per floor. Determine quantities and locations required.
2. Install in other locations indicated on the drawings.
3. Install per manufacturer's installation instructions.

R. Expansion Loops / Seismic Expansion Joints:
1. Install at building seismic expansion joints.
2. Install in other locations indicated on the drawings.
3. Install per manufacturer's installation instructions.

S. Pipe Wrap:
1. Apply per manufacturer's written instructions.
2. Apply wrapping to fittings in field after installation.

3.02 IDENTIFICATION

A. Valve Identification:
1. Valve Tags:
a. Attach to valve with a brass chain.
b. Valve tag numbers continuous throughout the building for each system. Obtain a list for each system involved from the
2. Valve Tag Directory:
a. Post final copy in Operation and Maintenance Manual.

B. Piping Markers:
1. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, painting, or other similar work, as follows:
a. Every 20-feet along continuous exposed lines.

b. Every 10-feet along continuous concealed lines.
c. Adjacent to each valve and stub out for future.
d. Where pipe passes through a wall, into and out of concealed spaces.
e. On each riser.
f. On each leg of a T.
g. Locate conspicuously where visible.

2. Apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow. Arrows to be the same color and sizes as identification labels.

C. Equipment Identification:
1. Nameplates:
a. Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.
2. Nameplate Directory:
a. Post final copy in Operation and Maintenance Manual.

3.03 EXTRA STOCK

A. Provide additional number of heads of each type and temperature rating installed as required to meet NFPA 13 requirements.

B. Provide storage cabinet or cabinets as required to receive reserve sprinkler heads and special installation tools required.

C. Provide index label for each head indicating manufacturer, model, orifice size of K-factor, and temperature rating.

D. Provide, inside cabinet a list of heads stored within and brief description of where installed.

E. Locate cabinet near sprinkler control station as approved.

3.04 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Perform tests and arrange for required inspections of installed system as required.
2. Notify the Architect 48 hours prior to any test or inspection.
3. Provide final test and certification in the presence of an Owner representative. Coordinate hereunder.

B. Inspection Service:
1. At start of warranty year, execute inspection agreement.
2. Without additional charge to Owner, make quarterly inspection of system during year.
a. Check and operate control valves.
b. Lubricate valve parts.

C. Report each inspection to Owner.

END OF SECTION

SECTION 22 0500

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. The intent of Division 22, Plumbing and the accompanying Drawings is to provide a complete and workable facility with complete systems as shown, specified and required by applicable codes. Include all work specified in Division 22, Plumbing and shown on the accompanying Drawings, including appurtenances, connections, etc., in the finished job.

B. Division 22, Plumbing and the accompanying Drawings are complementary and as binding as if called for by both. Items shown on the Drawings are not necessarily included in the Specifications and vice versa. Specifications supersede drawings in case of conflict.

C. The Drawings that accompany the Division 22, Plumbing, are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Offsets and transitions assumed at a minimum at each duct crossing, structural penetrations through shear walls or beams, structural grids where ceiling heights are restricted, and at piping mains. Follow the Drawing as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the Building, subject to approval, and without additional cost to the Owner. The right is reserved to make any reasonable changes in fixture location prior to roughing-in, without cost impact.

D. The General and Supplemental Conditions apply to this Division, including but not limited to:
   1. Drawings and specifications.
   2. Public ordinances, permits.
   3. Include payments and fees required by governing authorities for work of this Division.

1.02 RELATED SECTION

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Products and equipment prohibited from containing pentabrominated, octabrominated and decabrominated diphenyl ethers. Where products or equipment within this specification contain these banned substances, provide complying products and equipment from approved manufacturers with equal performance characteristics.
   2. General:
      a. Conform work and materials to local and State codes, and Federal, State and other applicable laws and regulations.
   3. Responsible for obtaining and payment for permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.

B. New materials and equipment. Work of good quality, free of faults and defects and in conformance with the Contract Documents.

C. Build and install apparatus to deliver its full rated capacity at the efficiency for which it was designed.

D. Operate the entire plumbing system and apparatus at full capacity without objectionable noise or vibration.

E. Install equipment level and true. Use housekeeping pads and curbs to account for floor or roof slope.

F. Materials and Equipment:
   1. Meet detailed requirements of the Drawings and Specifications and suitable for the installation shown. Equipment not meeting requirements will not be acceptable, even though specified by name along with other manufacturers.
   2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
   3. Furnish materials and equipment of size, make, type, and quality herein specified.
   4. Equipment scheduled by performance or model number considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the contractor is responsible for changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements or any other differences which impact the project.

G. Workmanship:
   1. General:
      a. Install materials in a neat and professional manner.
   2. Manufacturer’s Instructions:
      a. Follow manufacturer’s directions where they cover points not specifically indicated.
      b. If in conflict with the Drawings and Division 22, Plumbing, obtain clarification before starting work.

H. Cutting and Patching:
   1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.
   2. Additional openings required in building construction made by drilling or cutting. Use of jackhammer is specifically prohibited.
   3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
   4. Do not pierce beams or columns without permission of Architect and then only as directed.
   5. Restore new or existing work cut or damaged to its original condition. Where there are alterations disturb lawns, paving, walks, etc., repair, refinish, and leave in condition existing prior to commencement of work.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Contract Drawings indicate the general layout of the piping, and various items of equipment.
   2. Coordinate with other trades and field conditions.
   3. Prepare Shop Drawings of piping, and equipment installations.
   4. Prepare new Shop Drawings by Contractor and not reproductions or tracings of Architect’s Drawings.
   5. Overlay drawings with shop drawings of other trades and check for conflicts.
   6. Drawings same size as Architect’s Drawings with title block similar to Contract Drawings and identifying Architect’s Drawing number or any reference drawings.
   7. Fully dimensioned including both plan and elevation dimensions.
   8. Shop drawings cannot be used to make scope changes.
   9. Prepare in two-dimensional format.
   10. Shop drawings include but are not limited to:
      a. Complete floor plans with plumbing to a minimum of 1/4-inch equals 1-foot scale.

b. Beam penetration drawings indicating beam penetrations meeting the requirements indicated on the floor plans and on the structural drawings to a minimum of 1/4-inch equals 1-foot scale.

11. Submit shop drawings for review prior to beginning fabrication. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.

B. Product Data:
   1. Submit product data for review on scheduled pieces of equipment, on equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include manufacturer's detailed shop drawings, specifications and data sheets. Data includes the following:
      a. Capacities
      b. RPM
      c. BHP
      d. Pressure Drop
      e. Design and Operating Pressures
      f. Temperatures
   2. Manufacturer's abbreviations or codes are not acceptable.
   3. List the name of the motor manufacturer and service factor for each piece of equipment.
   4. Indicate equipment operating weights including bases and weight distribution at support points.
   5. In the case of equipment such as wiring devices, time switches, valves, etc., specified by specific catalog number, a statement of conformance will suffice.

C. Submission Requirements:
   1. Shop Drawings and Product Data:
      a. Refer to Division 01, General Requirements for additional requirements related to submittals.
      b. Submit electronic copies of shop drawings and product data for Work of Division 22, Plumbing in PDF format with each item filed under a folder and labeled with its respective specification section number, article, and paragraph and mark, if applicable.
      c. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
      d. The bulk of the shop drawings and product data included with the original submittal. Partial submittals will not be accepted. Other stragglers submitted after return of the original binder includes a tab similar to that originally submitted. Upon receipt of the returned late submittal, insert them in the previously submitted binder.

D. Contractor Responsibilities:
   1. Submit submittals at one time and in proper order.
   2. Ensure equipment will fit in the space provided.
   3. Assure that deviations from Drawings and Specifications are specifically noted in the submittals. Failure to comply will void review automatically.

1.05 AS-BUILT DRAWINGS

A. Provide record drawings in hard copy and pdf format. Drawings include the following:
   1. Project specific titleblock.
   2. Notations reflecting the as built conditions of any additions to or variations from the construction documents provided as part of the BIM coordination, RFIs, ASIs, Owner Changes, and Field Coordination.

1.06 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNER'S INSTRUCTIONS

A. Refer to Division 01, General Requirements for additional requirements.

B. Submit electronic copies of manufacturer's operation and maintenance instruction manuals and parts lists for each piece of equipment or item requiring servicing.

C. Submit data when the work is substantially complete. Include name and contact information for location of source parts and service for each piece of equipment.

D. Clearly mark and label in each submittal, the piece of equipment provided with the proper nameplate and model number identified. Provide wiring diagrams for electrically powered equipment.

E. Instruct Owner thoroughly in proper operation of equipment and systems, in accordance with manufacturer's instruction manuals. Operating instructions cover all phases of control.

F. Furnish competent engineer knowledgeable in this building system for minimum of one eight-hour day to instruct Owner in operation and maintenance of systems and equipment. Keep a log of this instruction including dates, times, subjects, and those present and present such log when requested by Architect.

1.07 PROJECT CONDITIONS

A. Existing Conditions:
   1. Prior to bidding, verify and become familiar with existing conditions by visiting the site, and include factors which may affect the execution of this Work.
   2. Include related costs in the initial bid proposal.

B. Coordinate exact requirements governed by actual job conditions. Check information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, City, and Utility Company.

1.08 WARRANTY

A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.

B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.

C. Correct warranty items promptly upon notification.

1.09 PROVISIONS FOR LARGE EQUIPMENT

A. Make provisions for the necessary openings in building to allow for admittance of equipment.

1.10 TEST REPORTS AND CERTIFICATES

A. Submit one copy of test reports and certificates specified herein to the Architect.

1.11 SUBSTITUTIONS

A. Submit requests for product substitutions in accordance with the Instructions to Bidders and the General and Supplemental Conditions.

PART 2 PRODUCTS

2.01 ACCESS PANELS

A. Furnish under this Division as specified in another Division of work.

2.02 PIPE SLEEVES

A. Interior Wall and Floor Sleeves: 18 gauge galvanized steel, or another pre-approved system.

B. Interior Wall and Floor Sleeves, Fire Rated: Fire rated and water tight system approved by Authority Having Jurisdiction and Owners Insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.

C. Exterior Wall Sleeves: Cast iron.

D. On Grade Floor Sleeves: Same as exterior wall sleeves.

E. Water Tight Sleeves: Combination steel pipe sleeves with water stop and anchor plate; Link Seal Model WS, mated with synthetic rubber links interlocked with bolts and nuts; Link Seal Model LS.

2.03 FLOOR, WALL AND CEILING PLATES

A. Furnish stamped split type plates as follows:
   1. Floor Plates: Cast brass, chromium plated
   2. Wall and Ceiling Plates: Spun aluminum

2.04 MACHINERY GUARDS

A. Furnish guards for protection on rotating and moving parts of equipment. Provide guards for metal fan drives and motor pulleys, regardless of being enclosed in a metal cabinet.

B. Design guards so as not to restrict airflow at fan inlets resulting in reduced capacity.

C. Provide shaft holes in guards for easy use of tachometers at pulley centers. Easily removable for pulley adjustment or removal and changing of belts.

D. Meet OSHA requirements including back plates.

E. Provide inlet and outlet screens on fans in plenums or where exposed to personnel.

2.05 ELECTRICAL EQUIPMENT

A. General:
   1. Equipment and installed work as specified under Division 26, Electrical.

B. Coordinate with the electrical Drawings and electrical contractor for minimum electrical equipment bracing requirements based on the available interrupting current (AIC) rating at the bus of the panelboard or switchboard serving the piece of equipment. Provide equipment that meets the bracing requirement.

C. Motors – AC Induction:
   1. Furnish as integral part of driven equipment. Drip-proof induction type with ball bearings unless noted otherwise. Motors 1 HP and above premium energy efficient type, except for emergency equipment motors. NEMA Standards for the service intended. Rated for the voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage.
   2. Energy Efficient Motors:
      a. Baldor
      b. Westinghouse
      c. General Electric
      d. Or approved equal.
   3. Meet the efficiency standards identified in the table below as determined using the IEEE Method B test at full load.

MINIMUM MOTOR EFFICIENCIES					
		RPM IEEE 112B Efficiency			
HP	KW	900	1200	1800	3600
1	0.75	--	82.5	85.5	80.0
1.5	1.15	--	86.5	86.5	85.5
2	1.53	--	87.5	86.5	86.5
3	2.3	84.0	89.5	89.5	88.5

   4. Refer to Equipment Schedules on the Drawings for motor horsepower, voltage, and phase.
   5. Refer to individual product sections for additional motor requirements.
   6. Built-in thermal overload protection, or protected externally with separate thermal overload devices with low voltage release or lockout. Hermetically sealed motors have quick trip devices.

7. Motors located in environment air plenums not tied to air handling functions totally enclosed type motors.

D. Motors – Electronic Commutation (EC):
   1. Furnish as integral part of driven equipment.
   2. Permanently lubricated with ball bearings unless noted otherwise.
   3. Internal motor circuitry convert AC power supplied to the motor to DC power to operate the motor.
   4. Speed controllable down to 20 percent of full speed.
   5. Motor efficiency minimum of 85 percent at speeds.
   6. Refer to Equipment Schedules on the Drawings for motor horsepower, voltage, and phase.
   7. Refer to individual product sections for additional motor requirements.
   8. Built-in thermal overload protection, or be protected externally with separate thermal overload devices with low voltage release or lockout. Hermetically sealed motors have quick trip devices.
   9. Motors located in environment air plenums not tied to air handling functions totally enclosed type motors.

E. Starters: Provided under Division 26, Electrical, suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.

F. Equipment Wiring:
   1. Provide interconnecting wiring within or on a piece of mechanical equipment with the equipment unless shown otherwise. This does not include the wiring of motors, starters and controllers provided under Division 26, Electrical.

G. Control Wiring: Provide control wiring for plumbing equipment

H. Codes: Electrical equipment and products bear the Underwriters label as required by governing codes and ordinances.

PART 3 EXECUTION

3.01 ACCESS PANELS

A. Install in accord with manufacturer's recommendations, coordinated with architectural features.

B. Provide 2-hour fire rated doors where required bearing the UL label.

C. Furnish 18-inch by 18-inch panels for ceilings and for access to equipment in soffits and shafts, and 12-inch by 12-inch for walls unless indicated otherwise.

D. Furnish where indicated and where required to access valves, trap primers, shock arresters, and other appurtenances requiring operation, service, or maintenance. Submit proposed locations for review prior to installation.

3.02 SLEEVES

A. Interior Floor and Wall Sleeves:
   1. Provide sleeves large enough to provide 3/4-inch clearances around pipe.
   2. Where pipe is insulated, provide sleeves large enough to provide 3/4-inch clearance around insulation. Maintain continuous insulation as it passes through sleeve.
   3. Penetrations through mechanical room and fan room floors made watertight by packing with safing insulation and sealing with Tremco Dymeric Sealant or approved system.

B. Sleeves Through Rated Floors and Walls:
   1. Similar to interior sleeves except install fire rated system approved by Authority Having Jurisdiction and Owners insurance underwriter
   2. Rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.

C. Exterior Wall Sleeves Below Grade:
   1. Provide water tight sleeves. Install at pipes entering building below grade and where shown. Adjust to provide positive hydrostatic seal.
   2. Responsible for following manufacturer's procedure for installing and tightening seal. Secure sleeves against displacement.

D. On Grade Floor Sleeves: Same as below grade exterior wall sleeves, caulked from inside.

E. Exterior Wall Sleeves Above Grade: Similar to interior wall sleeves except caulk outside with Tremco Dymeric Sealant.

F. Layout work prior to concrete forming. Do cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.

G. Floor sleeves maintain a water barrier by providing a water tight seal or they extend 1-inch above finished floor except through mechanical equipment room floors and shafts where sleeves extend 2-inches above finished floor level. Sleeves through roof extend 8-inches above roof. Wall sleeves flush with face of wall unless otherwise indicated. Waste stacks using carriers have sleeves flush with floor and sealed. Sleeves through planters extend 8-inches above planter base.

H. Do not support pipes by resting pipe clamps on floor sleeves. Provide supplementary members so pipes are floor supported.

I. Special sleeves detailed on drawings take precedence over this Section.

3.03 CLEANING

A. General: Clean plumbing equipment, fixtures and piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.

B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

C. Additional requirements are specified under specific Sections of this Division.

3.04 EQUIPMENT PROTECTION

A. Keep pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, fixtures, equipment, and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment, or apparatus to original conditions or replace at no cost to the Owner.

B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.

C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.05 ACCESSIBILITY

A. General: Locate valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.

B. Thermometers and Gauges: Install thermometers and gauges so as to be easily read from the floors, platforms, and walkways.

3.06 FLOOR, WALL AND CEILING PLATES

A. Install on piping passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates completely cover opening around pipe.

B. Secure wall and ceiling plates to pipe, insulation, or structure.

C. Plates not to penetrate insulation vapor barriers.

D. Plates not required in mechanical rooms or unfinished spaces.

3.07 ADJUSTING AND CLEANING

A. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations made accordingly and that recommended lubricants have been used.

B. Use particular care in lubricating bearings to avoid damage by overlubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.

3.08 ELECTRICAL EQUIPMENT

A. Do not install piping for plumbing systems not serving electrical space in switchgear room, transformer vault, telephone room, or electric closet except as indicated.

B. Piping for plumbing systems not to pass over switchboards or electrical panelboards. Where conflicts exist, bring to attention of Architect.

3.09 EQUIPMENT CONNECTIONS

A. Make final connections to equipment specified in sections other than Division 22, Plumbing of the specifications and Owner furnished equipment in accordance with manufacturer's instructions and shop drawings furnished and as indicated.

B. Piping:
   1. Connections include hot and cold water, sanitary waste and vent, storm drain.
   2. Provide valves and specialties as specified and as detailed on the Drawings. Provide increasers, reducers, and any other fittings required for complete installation.
   3. Independently support piping connections to prevent undue strain on equipment.

END OF SECTION

SECTION 22 0518

PLUMBING EXPANSION COMPENSATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Expansion Loops/Seismic Expansion Joints

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

C. Section 22 0529, Hangers, Supports and Anchors for Plumbing

D. Section 22 2113, Pipe and Pipe Fittings Plumbing

1.03 SUBMITTALS

A. Submit the following:
   1. Product Data
   2. Shop Drawings showing details of construction, dimensions, arrangement of components, and isolation.
   3. Structural Details and Calculations: Submit structural details and calculations substantiating that building structure, anchorages, and fabricated steel braces can safely withstand maximum calculated loads.
   4. Specified testing requirements.
   5. Operating and Maintenance Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Loops/Seismic Expansion Joints:
   1. Metraflex Metraloop
   2. Other Manufacturers: Submit substitution request.

2.02 EXPANSION LOOPS / SEISMIC EXPANSION JOINTS

A. Description:
   1. Flexible stainless steel hose and braid connector.
   2. Connector accepts differential support displacement without damaging pipe, equipment connections, or support connections.
   3. Materials of construction and pressure ratings be appropriate for the application as specified for each piping material and service.

PART 3 EXECUTION

3.01 EXPANSION LOOPS/SEISMIC EXPANSION JOINTS

A. Install at building seismic expansion joints.

B. Install in piping to compensate for thermal expansion and contraction. Determine quantities and locations required.

C. Install in other locations indicated on the drawings.

D. Install per manufacturer’s installation instructions.

END OF SECTION

SECTION 22 0519

METERS AND GAUGES FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Thermometers, Water
   2. Pressure Gauges

1.02 RELATED SECTIONS

A. Division 01, General Requirements

1.03 SUBMITTALS

A. Submit the following:
   1. Products listed in this Section.
   2. Operating and Maintenance Data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermometers, Water
   1. Ashcroft
   2. Weiss
   3. Trerice
   4. Marsh
   5. Weksler
   6. Tel-Tru
   7. Other Manufacturers: Submit substitution request.

B. Pressure Gauges:
   1. Marsh
   2. Ashcroft
   3. Weiss
   4. Trerice
   5. Weksler
   6. Tel-Tru
   7. Other Manufacturers: Submit substitution request.

C. Other Manufacturers: Submit substitution request.

2.02 THERMOMETERS, WATER

A. Description: Direct drive 5-inch dial type, stainless steel case, separable sockets, stem length to penetrate minimum of 1/2 pipe diameter, adjustable face, extension necks where required to clear insulation.

B. Range:

Plumbing Systems	Temperature	Graduations
Domestic Cold Water	25-125 degrees F	1 degrees F
Domestic Hot Water	30-180 degrees F	2 degrees F

2.03 PRESSURE GAUGES

A. Description: 4-1/2-inch dial, molded black polypropylene turret case.

B. Range:

Plumbing Systems	Pressure (psi)	Graduations (psi)
Domestic Cold Water	0-160 psi	1 psi
Domestic Hot Water	0-160 psi	1 psi

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Provide gauges where shown on Drawings.

B. Install gauges as required and as recommended by equipment manufacturer or their representative.

C. Extend connections, wells, cocks, or gauges to a minimum of 1-inch beyond insulation thickness of the various systems.

D. Locate gauges so that they may be conveniently read at eye level or easily viewed and read from the floor or from the most likely viewing area.

E. Install instruments over 6-feet 6-inches above floor, to be viewed from the floor, with face at 30 degrees to horizontal.

3.02 INSTALLATION - PRESSURE GAUGES

A. Provide instrument gauge cock at inlets. Locate pressure gauge taps for measuring pressure drop or increase across pumps, etc., as close to the device as possible.

END OF SECTION

SECTION 22 0523

GENERAL DUTY VALVES AND SPECIALTIES FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Check Valves
   2. Ball Valves
   3. Butterfly Valves
   4. Balancing Valves
   5. Specialty Valves

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 SUBMITTALS

A. Submit product data.

1.04 DEFINITIONS

A.	CWP	Cold working pressure
B.	EPDM	Ethylene propylene copolymer rubber
C.	NBR	Acrylonitrile-butadiene, Buna-N, or nitrile rubber
D.	NRS	Nonrising stem
E.	RS	Rising stem
F.	PTFE	Polytetrafluoroethylene plastic
G.	SWP	Steam working pressure
H.	Lead Free	Section 1417 of the Safe Drinking Water Act (SDWA) establishes the definition for lead free as a weighted average of 0.25 percent lead calculated across the wetted surfaces of a pipe, pipe fitting, plumbing fitting, and fixture and 0.2 percent lead for solder and flux. The Act provides a methodology for calculating the weighted average of wetted surfaces.

1.05 QUALITY ASSURANCE

A. ASME Compliance:
   1. ASME B16.10 for ferrous valve dimensions.
   2. ASME B31.9 for building services piping valves.

B. NSF Compliance: NSF/ANSI 61 and/or NSF/ANSI 372 for valve materials for potable-water service. ANSI/NSF-359

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General: Where only NIBCO figure numbers are listed, equivalent products by those specified below are acceptable.
   1. Valves:
      a. Swing Check:
         1) Apollo
         2) Milwaukee
         3) Walworth
         4) Hammond
      b. Silent Check:
         1) Mueller

2) Metraflex
3) Bell and Gossett
4) Milwaukee

c. Balancing:
1) Jomar
2) Bell and Gossett
3) Armstrong
4) Tour and Anderson
5) NIBCO

d. Butterfly:
1) Apollo
2) Walworth
3) Milwaukee
4) Metraflex

e. Ball:
1) Apollo
2) Hammond
3) Milwaukee

2. Specialty Valves:
a. Gauge Cocks:
1) Apollo 41 Series

B. Other Manufacturers: Submit substitution request.

C. Use only one manufacturer.

D. Valve ends may be threaded, flanged, soldered, or grooved, as applicable to piping system. Refer to Section 22 2113, Pipe and Pipe Fittings Plumbing for allowable fittings.

2.02 CHECK VALVES

A. Lead Free Y-Pattern Horizontal Bronze Swing Check: Lead Free Silicon Bronze corrosion resistant body, and trim, PTFE renewable seat and disc, 200 psi CWP; NIBCO S/T 413-Y-LF.

B. Lead Free Horizontal Iron Swing Check: Iron body, wafer style, renewable seat and disc, 200 CWP psi rating, 200 psi Non-Shock Cold Working Pressure, NIBCO W-910-LF.

C. Lead Free Vertical and Silent Check Valves:
1. 250 pound, WOG, silicon bronze alloy, lift type, resilient disc, spring actuated, solder connections, NIBCO S-480-Y-LF.

2.03 BALL VALVES

A. Lead Free Bronze Ball: Two piece, full port, lead free silicon bronze body, Stainless steel or silicon bronze trim, Reinforced PTFE or TFE seats, 600 psi CWP NIBCO T/S-585-80-LF or T/S-585-66-LF.

2.04 BUTTERFLY VALVES

A. Lead Free Butterfly Valve: Ductile iron body, Lead Free Aluminum Bronze disc and stainless steel stem, with lever handle and locking feature on valves 6-inches and less; stem neck length to accommodate insulation where applicable, EPDM liner, 200 psi water; NIBCO LD- 2000N-3/5,

2.05 BALANCING VALVE

A. Lead-Free Manual Calibrated:
1. Lead-free brass venturi, differential pressure readout valve, two pressure test ports, leakproof stem, ball valve shutoff.
2. Suitable for tight shutoff, memory stops, threaded, grooved or soldered ends, 600 WOG, 300F max, NSF 61-8 and NSF 372 compliant.
3. Jomar.

2.06 SPECIALTY VALVES

A. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch.

B. Drain Valves: Bronze globe valve or full port ball valve, garden hose end, cap, and chain 3/4-inch size.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide valves at connections to equipment where shown or required for equipment isolation.

B. Provide separate support for valves where necessary.

C. Provide drain valves in low points in the piping system, at coils and equipment, and as indicated.

D. Install in accordance with manufacturer's recommendations.

3.02 APPLIED LOCATIONS PLUMBING VALVES

A. In piping 2-inches and smaller:

System	Valve Types				
	Gate	Globe	Swing Check	Ball	Butterfly
Domestic Hot	NA	NA	Lead Free Bronze	Lead Free Bronze	Not Allowed
Domestic Cold	NA	NA	Lead Free Bronze	Lead Free Bronze	Not Allowed

B. In piping 2-1/2-inches and larger:

System	Valve Types				
	Gate	Globe	Swing Check	Ball	Butterfly
Domestic Cold	NA	NA	Lead Free Iron	Not Allowed	Lead Free Ductile Iron

C. Calibrated balancing valves on domestic hot water. Size balancing valves based on the published performance curve characteristics for the scheduled flow rate for each location to ensure proper operation at design conditions.

D. Silent check valves on pump discharge for domestic hot water.

E. Provide gauge cock for all pressure gauges.

3.03 VALVE IDENTIFICATION

A. General: Identify valves to indicate their function and system served.

B. Refer to Section 22 0553, Identification for Plumbing Piping and Equipment.

END OF SECTION

SECTION 22 0529

HANGERS SUPPORTS AND ANCHORS FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Supports, Anchorage and Restraint
   2. Pipe Attachments
   3. Pipe Rollers, Insulation Protection Shields and Insulation Protection Saddles
   4. Building Attachments

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

C. Section 22 0700, Insulation for Plumbing

D. Section 22 2113, Pipe and Pipe Fittings Plumbing

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings of contractor fabricated piping support structures.
   2. No other submittals required under this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Supports, Anchorage and Restraint:
   1. Unistrut
   2. Superstrut
   3. Powerstrut and Kinline
   4. B-Line Systems
   5. AnvilStrut

B. Pipe Attachments:
   1. Anvil
   2. Superstrut
   3. B-Line Systems
   4. Tolco
   5. ERICO

C. Pipe Rollers, Insulation Protection Shields and Insulation Protection Saddles:
   1. Anvil or equivalent
   2. Super Strut
   3. B-Line Systems
   4. Tolco
   5. ERICO

D. Building Attachments:
   1. Anvil as listed or equivalent products
   2. Elcen
   3. Superstrut
   4. B-Line Systems
   5. Tolco
   6. ERICO

2.02 SUPPORTS, ANCHORAGE AND RESTRAINT

A. General:
   1. Provide pipe and equipment hangers and supports in accordance with the following:
      a. Equipment, supports, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor responsible for their design.
      b. Resist seismic forces as specified in the latest edition of the International Building Code for the seismic zone in which the project is constructed.
      c. Seismic restraint not to introduce excessive stresses in the piping caused by thermal expansion or contraction.
      d. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
      e. In accordance with the latest edition of the SMACNA Seismic Restraint Manual - Guidelines for Mechanical Systems for the Seismic Hazard Level corresponding to the seismic zone in which the project is constructed.
      f. In accordance with the applicable code.
      g. Follow provisions described in Section 22 0548, Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Engineered Support Systems: Design, detail, and bear the seal of a professional engineer registered in the State having jurisdiction.
   1. Supports and seismic restraints for suspended piping and equipment.
   2. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.
   3. Equipment and piping support frame anchorage to supporting slab or structure.

C. Fabricate support members from welded standard structural shapes, pipe, and plate to carry the necessary rollers, hangers, and accessories as required.

D. Support piping less than 4-inch pipe size from or by prefabricated roll-formed channels with necessary accessories to adequately support piping system.

E. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.

F. Dissimilar Metal Protection: Hydra-Zorb cushions or Cush-a-strip.

G. Clamps: Super Strut Series 700 through 702 or AnvilStrut Series 1000 through 1200.

2.03 PIPE ATTACHMENTS

A. Uninsulated Horizontal Copper Piping:
   1. 2-inch and Smaller: Anvil CT-65, CT-69, CT-99C.
   2. Larger than 2-inch:
      a. Anvil 260 field or factory copper plated, plastic coated or other recognized industry methods.
      b. Electricians' tape is unacceptable.

B. Insulated Horizontal Copper Pipe with Hangers Inside of Insulation: Same as Uninsulated Horizontal Copper Pipe.

C. Insulated Horizontal Copper Pipe with Hangers Outside of Insulation:
   1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
   2. Larger than 2-inch: Anvil 260.

D. Other Uninsulated Horizontal Pipe:
   1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
   2. Larger than 2-inch: Anvil 260.

E. Other Insulated Horizontal Pipe With Hangers Inside of Insulation:
   1. 2-inch and Smaller: Anvil 65, 70, 104, 260 or 300.
   2. Larger than 2-inch: Anvil 260.

F. Other Insulated Horizontal Pipe with Hangers Outside of Insulation:
   1. 2-inch and Smaller: Anvil 65, 70, 104 or 260.
   2. Larger than 2-inch: Anvil 260.

G. Riser Clamps Copper Pipe:
   1. 4-inch and Smaller: Anvil CT-121, CT-121C or 261C.
   2. Larger than 4-inch: Anvil 261C.

H. Riser Clamps Other Piping: Anvil 261.

2.04 PIPE ROLLERS, INSULATION PROTECTION SHIELDS AND INSULATION PROTECTION SADDLES

A. Pipe Rollers:
   1. Anvil 174 or 274 as required.
   2. Size for pipe plus insulation for insulated pipe.

B. Insulation Protection Shields: Anvil 167

C. Insulation Protection Saddles: Anvil 160 through 166A as required. Saddles for copper pipe, factory, or field copper plated.

2.05 BUILDING ATTACHMENTS

A. Beam Hangers:
   1. On piping 6-inch and smaller: Anvil 86 with retaining clip Figure 89.
   2. On piping larger than 6-inch: Anvil 228, or 292.

B. Inserts:
   1. Anvil 152 malleable iron or 281 steel inserts.
   2. Inserts sized for required rod to support load being carried.

C. Expansion Plugs: Similar and equal to Phillips red-head self-drilling flush shell selected for safety factor of 4.

D. Powder actuated fasteners with silencers as approved by Architect.

PART 3 EXECUTION

3.01 HANGERS AND SUPPORTS

A. General:
   1. Install support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required, and as detailed on the Drawings.
   2. Provide adjustable hangers for pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise.
   3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
   4. Except as otherwise indicated for exposed continuous pipe runs, install hangers, and supports of same type and style as installed for adjacent similar piping.
   5. Install cast iron piping in accordance with Cast Iron Soil Pipe Industry (CISPI) Standards.
   6. Support piping within 2-feet of each change of direction on both sides of fitting.

B. Insulated Piping Systems:
   1. Refer to Section 22 07 00, Insulation for Plumbing for insulation requirements.
   2. Insulated Piping Systems with Vapor Barrier Insulation:
      a. Install hangers outside of insulation.
      b. On piping 1-1/2-inch and larger, provide insulation protection shields at each support location.

3. Insulated Piping Systems with Non-Vapor Barrier Insulation:
    a. At the contractor's option, hangers may be installed inside or outside of insulation for piping 2-inch and smaller.
    b. If hangers are installed outside of insulation, provide insulation protection shields at support locations on piping 1-1/2-inch and larger.
    c. On piping larger than 2-inch, provide insulation saddles at each support location.
4. Insulation Protection:
    a. Band insulation protection shields firmly to insulation to prevent slippage.

C. Horizontal Piping:
1. Trapeze Hangers:
    a. Multiple pipe runs where indicated supported on channels with rust resistant finish.
    b. Provide necessary rods and supporting steel.
2. Support Spacing:
    a. Provide support at minimum spacing per MSS SP-69-1996 Pipe Hangers and Supports - Selection and Application:
        1) Support piping within 2-feet of each change in direction.
        2) Steel Pipe, Copper Tubing:

Minimum Pipe Size	Maximum Span Steel	Maximum Span Copper	Maximum Span Pex A pipe with Pex a Pipe Channel	Rod Size
1-inch and smaller	7-feet	5-feet	6-feet	1/4-inch
1-1/4-inch to 2-inch	8-feet	8-feet	8-feet	3/8-inch
2-1/2-inch to 3-inch	11-feet	9-feet	8-feet	1/2-inch
4-inch to 5-inch	14-feet	12-feet	-	1/2-inch

        3) Plumbing Piping: Support in accordance with local plumbing code.
        4) Plastic Pipe: Supported a maximum of 3-feet on center for piping 1-inch and smaller and 4-feet on center for piping 1-1/4-inch and larger with rod sizes as recommended by the manufacturer.

D. Building Attachments:
1. Fastening or attaching to steel deck (without concrete fill) is prohibited. It will be necessary to support piping from structural members, beams, joists, or provide intermediate angle iron supporting members between joists. Supports may be attached to concrete filled steel deck with load limitations shown on the structural drawings or otherwise obtained from the structural engineer.
2. Provide horizontal bracing on horizontal runs 1-1/2 inch and larger and exceeding 50-feet in length at 75-foot intervals and as required to provide stabilized piping systems.
3. Provide additional structural steel angles, channels, or other members required to support piping where structures do not occur as required for proper support.
4. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points.

END OF SECTION

SECTION 22 0548
SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Seismic Restraints

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

C. Section 22 0529 Hangers, Supports and Anchors for Plumbing

1.03 QUALITY ASSURANCE

A. Seismic Restraints:
   1. Restraint of piping to be in accordance with the current state and local Building Code.
   2. Calculations in accordance with current state and local Building Code.

1.04 SUBMITTALS

A. Submit the following:
   1. Submit product data and calculation sheets for isolators, showing:
      a. Size, type, load rating, and rated deflection of each required isolator.
      b. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.

B. Installation report as specified in PART 3 of this Section.

1.05 CONTRACTOR RESPONSIBILITY

A. Adequately restrain piping to resist seismic forces. Design and select restraint devices to meet seismic requirements as defined in the latest issue of the International Building Code under Earthquake Design and applicable state and local codes.

B. Provide Engineering drawings, details, supervision, and instruction to assure proper installation and performance.

C. Provide whatever assistance necessary to ensure correct installation and adjustment of the isolators.

PART 2 PRODUCTS

2.01 SEISMIC RESTRAINTS

A. General Requirements:
   1. Provide for piping, both supported and suspended.
   2. Bracing of piping in accordance with the code and with the provisions set forth in the SMACNA seismic restraint manual.
   3. Structural requirements for the restraints, including their attachment to the building structure, reviewed and approved by the structural engineer.
   4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.

B. Supported Equipment:
   1. All-directional seismic snubbers consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene.
   2. Replaceable bushing and a minimum of 1/4-inch thick. Rated loadings not to exceed 1000 psi.
   3. Incorporate an air gap of 1/4-inch be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces.

4. Removable snubber end caps to allow inspection of internal clearances. Neoprene bushings rotated to ensure no short circuits exist before systems are activated.
5. Snubber Mason Industries, Inc. Type Z-1225

C. Bracing of Pipes:
1. Provide seismic bracing of all piping as detailed below to meet the building code requirements:
   a. Exception:
      1) Piping suspended by individual hanger's 12-inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced where the following criteria are met.
         a) Seismic braces are not required on high deformability piping when the Ip=1.0 and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 3-inches diameter or less.
         b) Seismic braces are not required on high deformability piping when the Ip=1.5 and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 1-inch diameter or less.
2. Seismic braces for pipes on trapeze hangers may be used.
3. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints, or where pipes connect to equipment.
4. Cast iron pipe of all types, glass pipe, and any other pipe jointed with a shield and clamp assembly, where the top of the pipe is 12-inches or more from the supporting structure, braced on each side of a change in direction of 90 degrees or more. Riser joints on unsupported sections of piping braced or stabilized between floors.
5. Vertical Risers:
   a. Laterally supported with a riser clamp at each floor.
   b. For buildings greater than six stories high or for piping subject to thermal change risers engineered individually.

D. Suspended Piping:
1. Seismic cable restraints consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.
2. Pre-stretch cable to achieve a certified minimum modulus of elasticity. Cable end connections steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.
3. Cable Assemblies: Mason Industries, Inc. Type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod and the clevis or SCBV if clamped to a beam.
4. Steel angles, sized to prevent buckling, clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies Mason Industries, Inc. Type SRC, or UC.
5. Pipe clevis cross-bolt braces are required in all restraint locations. Special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross brace Mason Industries, Inc. Type CCB.

PART 3 EXECUTION

3.01 GENERAL

A. Do not install equipment or pipe which makes rigid contact with the building.

B. Correct, at no additional cost, all installations which are defective in workmanship or materials.

C. Strap water heaters to wall per Plumbing Code.

3.02 PREPARATION

A. Coat steel frames exposed to weather with a rustproof metal primer.

B. Provide hot dipped galvanizing on steel frames as indicated on the plans for corrosion protection in severe conditions.

3.03 INSTALLATION

A. General:
   1. Provide rubber grommets and washers to isolate the bolt from the building structure. Do not destroy the isolation efficiency destroyed when bolting the isolators to the building structure.

3.04 SEISMIC RESTRAINTS

A. General:
   1. Install and adjust seismic restraints so that the piping support is not degraded by the restraints.
   2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

B. Bracing of Pipes:
   1. Branch lines may not be used to brace main lines.
   2. Transverse Bracing: Maximum 40-feet, except where a lesser spacing is indicated in the SMACNA tables for bracing of pipes
   3. Longitudinal bracing at 80-feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity to resist both the seismic load and the additional force induced by expansion and contraction.
   4. A rigid piping system shall not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.
   5. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24 inches of the elbow or tee.
   6. Subject to confirmation by field inspection, seismic bracing is not required on piping when the piping is supported by rod hangers and the hangers in the entire run are 12-inches or less in length from the top of the pipe to the supporting structure, hangers are detailed to avoid bending of the hangers and their attachments and provisions are made for piping to accommodate expected deflections.

C. Suspended Piping, Cable Method:
   1. Adjust cables to a degree of slackness approved by the Structural Engineer.

END OF SECTION

SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Valve Identification
   2. Piping Markers
   3. Equipment Identification

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 SUBMITTALS

A. Submit the following:
   1. Valve Tag Directory: Submit for approval prior to fabrication of valve tags.
   2. Operating and Maintenance Data: Include a copy of valve tag and equipment nameplate directories in each set of Operating and Maintenance manuals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Piping Markers:
   1. W.H. Brady
   2. Seton
   3. Marking Systems, Inc. (MSI)
   4. Other Manufacturers: Submit substitution request.

2.02 VALVE IDENTIFICATION

A. Valve Tags:
   1. General: Identify valves with metal tags, legends to be stamped or embossed. Numbering is not required or desired. Provide content, function and normal position as indicated below:

HW	(CONTENT OF PIPE)
ISOLATION	(VALVE FUNCTION)
NO	(NORMAL OPERATION POSITION)

   2. Size: Valve tags 2-inch diameter with 1/4-inch high letters.
   3. Material: Use 0.04-inch brass tags.
   4. Automatic Valves and Regulating Valves: Use 1/16-inch thick laminated 3-ply plastic, center ply white, outer ply red, lamicoid, or equal. Form letters by exposing center ply.

2.03 PIPING MARKERS

A. Label pipes with all-vinyl, semi-rigid plastic or strap-on labels.

B. For pipes O.D. smaller than 3/4-inch and for valve and fitting identification, use valve tag.

C. For sizes from 3/4 to 1-1/4-inch outside diameter, 1/2-inch letters, 8-inch marker width.

D. For sizes from 1-1/2 to 2-inch outside diameter, 3/4-inch letters, 8-inch marker width.

E. For sizes from 2-1/2 to 3-inch outside diameter, 1-1/4-inch letters, 12-inch marker width.

F. Identify and color-code pipe markers as follows with directional arrows.

PLUMBING SERVICE	PIPE MARKER*	BACKGROUND/TEXT COLOR
COLD WATER	DOMESTIC COLD WATER	GREEN/WHITE
HOT WATER	DOMESTIC HOT WATER SUPPLY	GREEN/WHITE
	DOM. HOT WATER RECIRC	GREEN/WHITE
SANITARY WASTE	SANITARY WASTE	GREEN/WHITE
STORM DRAIN	STORM DRAIN	GREEN/WHITE
VENT	VENT	GREEN/WHITE
* Directional arrow applied adjacent to pipe marker indicating direction of flow.		

2.04 EQUIPMENT IDENTIFICATION

A. Nameplates:
   1. Tag pumps and miscellaneous mechanical equipment items with engraved nameplates.
   2. 1/16-inch thick, 3-inch by 5-inch laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
   3. Identify unit with code number as shown on Drawings and area served.

PART 3 EXECUTION

3.01 VALVE IDENTIFICATION

A. Valve Tags:
   1. Attach to valve with a brass chain.

3.02 PIPING MARKERS

A. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
   1. Every 20-feet along continuous exposed lines.
   2. Every 10-feet along continuous concealed lines.
   3. Adjacent to each valve, flange, and stub-out for future.
   4. On pipe before and after wall, floor, and ceiling penetrations.
   5. On pipe into and out of concealed spaces.
   6. Adjacent to changes in pipe direction.
   7. On each riser.
   8. Adjacent to each leg of a T.
   9. Locate conspicuously where visible. Position pipe labels on pipe to achieve the best visibility.
   10. Provide pipe identification (over insulation) for reclaimed water systems in accordance with current local codes and rulings.
   11. Apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above.

B. Apply arrow labels indicating direction of flow.

3.03 EQUIPMENT IDENTIFICATION

A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.

END OF SECTION

SECTION 22 0590

PRESSURE TESTING FOR PLUMBING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Pressure Testing of Piping System

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 QUALITY ASSURANCE

A. Code Compliance: Perform required tests in the presence of the authority having jurisdiction.

B. Owner Witness: Perform all tests in the presence of the Owner's representative.

C. Engineer Witness: The Engineer or Engineer's representative reserves the right to observe all tests or selected tests to assure compliance with the specifications.

D. Simultaneous Testing: Test observations by the authority having jurisdiction, the Owner's Representative, and the Engineer's representative need not occur simultaneously.

1.04 SUBMITTALS

A. Submit the following test reports:
   1. Certificate of completion, inspection, and test by authority having jurisdiction on required piping systems.
   2. Certificate of test approval by Owner's representative on all systems.
   3. Engineer's representative will record witnessed tests.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION

3.01 GENERAL

A. Piping:
   1. Test prior to concealment, insulation being applied, and connection to equipment, fixtures, or specialties.
   2. Conduct tests with all valves but those used to isolate the test section 10 percent closed.

B. Leaks: Repair leaks and retest until stipulated results are achieved.

C. Notification:
   1. Advise the Construction Manager 72 hours in advance of each test.
   2. Failure to so notify will require test to be rescheduled.

D. Testing Equipment: Provide all necessary pumps, gauges, connections, and similar items required to perform the tests.

3.02 TESTING REQUIREMENTS

A. Sanitary and Roof Drainage Systems:
   1. Test entire system or sections of system by closing all openings in piping except highest opening and filling system with water to point of overflow. If system is tested in sections, plug each opening except highest opening of section under test and fill each section with water, but none with less than 10 feet head of water.
   2. Keep water in system or in portions under test for at least 45 minutes before inspection starts. Test for 2 hours with no drop allowed. Locate and repair leaks.

B. Domestic Water Systems:
   1. Test entire system by closing all openings in piping except highest opening and filling system with water to point of overflow.
   2. Keep water in system under test for a minimum of 45 minutes before inspection starts.
   3. Test at full working pressure for 2 hours with no drop allowed. Locate and repair leaks.

END OF SECTION

SECTION 22 0593

TESTING, ADJUSTING AND BALANCING FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Domestic Hot Water Recirculation Systems
   2. Pumping Systems

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 QUALITY ASSURANCE

A. Acceptable Testing and Balancing Firms:
   1. A.I.R., Inc.
   2. Air Balance Specialty, Inc.
   3. Neudorfer Engineers, Inc.
   4. Northwest Engineering Services
   5. American Commissioning Consultants
   6. Accurate Balancing Agency, Inc.

B. Other Firms: Submit substitution requests prior to bid date.

C. Industrial Standards:
   1. NEBB, American Society of Heating, Refrigerating
   2. Air Conditioning Engineers (ASHRAE)
   3. American National Standards Institute (ANSI) as follows:
      a. NEBB: Comply with Procedural Standards for Testing, Adjusting Balancing of Environmental Systems.
      b. ASHRAE: Comply with recommendations pertaining to measurements, instruments, and testing, adjusting and balancing.
      c. ANSI:
         1) S1.4 Specifications for sound level meters.
         2) S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.

D. Instrument Certification: Instruments used accurately calibrated and certified within six months of balancing and maintained in good working order.

E. Test Observation: If requested, conduct test in the presence of the Architect or the Architect's representative.

F. Pre-Balancing Conference:
   1. Review with the Engineer prior to starting balancing, general techniques.
   2. Conference must occur prior to measuring existing conditions.
   3. Measuring of existing conditions must occur prior to any demolition or new work.
   4. Review existing conditions and systems to be affected by the project

1.04 SUBMITTALS

A. Submit the following:
   1. Balancing Log:
      a. Include water outlets, actual field measured water volume, and percentage of design volumes.
      b. Provide drawings identifying location of outlets.

2. Equipment Data Sheets:
    a. Indicate actual equipment performance, model numbers, bearing and belt data, motor nameplate data, and final balanced motor data.
3. Additional Data: Submit additional data as provided by Associated Air Balance Council (AABC) Standard forms.
4. Number of Copies: Submit six copies of the above completed information to the Engineer for review and insertion into the Operating and Maintenance Data.
5. Instrument Certification: When requested, submit certificate of calibration for equipment to be used.

B. Record data on NEBB forms or forms approved by the Architect.

1.05 PROJECT CONDITIONS

A. Where existing systems are to be adjusted, establish flow rates in all branches prior to making any modifications to system. Submit preliminary report indicating existing conditions prior to making any modifications to existing systems. Adjust central equipment as required and restore unmodified branches and outlets to original condition. Obtain existing system drawings from Owner and become familiar with extent and nature of existing systems.

B. Do not perform final testing, adjusting, and balancing work until equipment has been completely installed and operating continuously as required.

C. Conduct testing and balancing with clean strainers and filters in place. Clean strainers, etc., prior to performing hydronic testing and balancing.

1.06 WARRANTIES

A. In addition to the Requirements of the Contract, include an extended warranty of six months after completion of test and balance work during which time the Architect at his discretion may request a recheck or resetting of any equipment or device listed in the test reports.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION

3.01 DOMESTIC HOT WATER RECIRCULATION SYSTEMS

A. General: Make measurements in accordance with Industrial Standards specified above. Record on appropriate forms.

B. Preliminary:
1. List complete data of tested equipment and verify against Contract Documents.
2. Open line valves to full open position.
3. For each new pump:
    a. Verify rotation.
    b. Test and record pump shut-off head.
    c. Test and record pump wide-open head.
4. Verify proper system pressures.

C. Distribution:
1. Read and adjust water flow for design conditions.
2. Set memory stops and mark position of adjuster on balancing valves.

3.02 DOMESTIC HOT WATER POINT OF USE MIXING VALVES

A. General: Make measurements in accordance with Industrial Standards specified above. Record on appropriate forms.

B. Preliminary:
1. List complete data of tested equipment and verify against Contract Documents.
2. Open line valves to full open position.

C. Distribution:
1. Adjust water flow for design conditions.
2. Set mixing valve to achieve desired leaving water temperature.
3. Set memory stops and mark position of adjuster on balancing valves.

3.03 COORDINATION

A. Coordinate work with other trades to ensure rapid completion of the project.

B. Deficiencies noted during the course of balancing in the mechanical installation promptly reported to the Architect to allow corrective action to proceed.

C. Provide periodic review of progress as requested.

END OF SECTION

SECTION 22 0700

INSULATION FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Pipe Insulation
   2. Accessories Piping

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

C. Section 22 0529, Hangers, Supports and Anchors for Plumbing

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Insulating products prohibited from containing pentabrominated, octabrominated and decabrominated diphenyl ethers. Where products within this specification contain these banned substances, provide complying products from approved manufacturers with equal performance characteristics.
   2. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723 or ASTM E84.
   3. Energy Codes: Local Building and Energy Codes govern where insulation performance requirements for thickness exceeds thickness specified.

B. Protection: Protect against dirt, water, chemical, or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost.

C. Source Quality Control:
   1. Service: Use insulation specifically manufactured for service specified.
   2. Labeling: Insulation labeled or stamped with brand name and number.
   3. Insulation and accessories not to provide nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin. Asbestos free and no interaction with corrosively with equipment, piping, or ductwork.

1.04 SUBMITTALS

A. Submit the following.
   1. Product Data: For each type including density, conductivity, thickness, jacket, vapor barrier, and flame spread and smoke developed indices.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General:
   1. Johns Manville
   2. Knauf
   3. Owens Corning
   4. CertainTeed
   5. Such insulation by one manufacturer.
   6. Other Manufacturers: Submit substitution request.

B. Pipe Insulation:
   1. Fiberglass:
      a. Johns Manville Microlok HP
   2. Calcium Silicate:
      a. Johns Manville Thermo-12 Gold

2.02 PIPE INSULATION

A. Fiberglass: Split sectional or Snap-On type with 0.23 per inch maximum thermal conductivity (K-factor) at 75 degrees F mean temperature, 850 degrees F maximum service rating and white, vapor barrier jacket with pressure sensitive closure system.

B. Calcium Silicate: Sectional with 14 pcf nominal density, 0.40 maximum K-factor at 300 degrees F mean temperature and 1200 degrees F maximum service rating.

2.03 ACCESSORIES PIPING

A. Adhesives:
   1. General: Maximum Flame Spread/Smoke Developed Rating of 25/50, SCAQMD Rule 1168 compliant.
   2. Fiberglass: Integral closure system.
   3. Calcium Silicate: Benjamin Foster 30-36.

B. Cements:
   1. Insulating: Ryder.
   2. Heat Transfer: Chemax Tracit-300.

C. Wire Mesh: 1-inch mesh with 20 gauge annealed steel wire.

D. Pipe Fitting Covers:
   1. One piece PVC insulated pipe fitting covers.
   2. Zeston, Ceel-Co.

E. Cloth Facing: Presized fiberglass cloth.

F. Tapes:
   1. Pressure sensitive, weather resistant, and for temperatures up to 150 degrees F.
   2. Zeston Z-tape.

PART 3 EXECUTION

3.01 GENERAL

A. Workmanship:
   1. Installation: Insulation installed in first class, neat professional manner.
   2. Applicators: Employed by firm that specializes in insulation work.

B. Preparation: Surfaces of piping and equipment clean, free of oil or dirt, and dry before insulation is applied.

C. Stamps: ASME stamps, UL labels, and similar stamps and labels are not covered.

3.02 PLUMBING PIPE AND EQUIPMENT INSULATION APPLIED LOCATIONS

A. Insulation Applied Locations – Plumbing Piping:

System	Pipe Size	Insulation Type	Insulation Thickness	Notes
Domestic Cold Water, Above Grade	1-1/4-inch and smaller	Fiberglass, all-purpose jacket	1/2-inch	
Domestic Cold Water, Above Grade	Above 1-1/4-inch	Fiberglass, all-purpose jacket	1-inch	
Domestic Hot Water Supply/Return, Above Grade	1-1/2-inch and smaller	Fiberglass, all-purpose jacket	1 1/2-inch	
Interior Storm Drain and Interior Overflow Drains	All	Fiberglass, all-purpose jacket	1/2-inch	Note 1
Note 1: Drain bodies, insulate the first 10-feet connected to the drain body, and horizontal piping. Do not insulate main vertical stack.				

B. The following piping is not insulated:
   1. Waste and vent, except where heat traced.
   2. Domestic cold water runouts to single fixture less than 12-inch long and exposed supplies.

3. Priming lines

C. Insulation include the following:
   1. Fittings
   2. Unions
   3. Flanges
   4. Mechanical Couplings
   5. Valve Bodies
   6. Valve Bonnets
   7. Piping through Sleeves except Valve Bonnets
   8. Unions and Flanges need not be insulated on the following systems:
      a. Domestic Hot Water

D. Insulate valves and irregular fittings with section of pipe insulation and insulating cement, securely fastened, and finished with 6 ounce canvas and Foster 30-36 lagging adhesive.

E. Flanges, valves not requiring a vapor barrier to insulate with removable replaceable pads fabricated of 1-inch layer of Pittsburgh Corning Temp Mat sandwiched between inner and outer layer of 8 oz. glass cloth held together with stainless staples with sufficient stainless lacing hooks to hold pad firmly to flange or valve with minimum 3-inch overlap onto adjacent pipe insulation using 18 gauge SS lacing wire.

F. Expansion Joints and Flexible Connectors: Pipe insulation or block of same material and thickness as adjacent piping.

3.03 PIPING INSTALLATION

A. General:
   1. Joints: Coat both sides of complete joining area with applicable adhesive.
      a. Longitudinal Joints: Make joints on top or back of pipe to minimize visibility. Except foam plastic, seal with closure system or 3-inch wide tape.
      b. Butt Joints: Butt lightly together and, except for foam plastic, seal with 3-inch wide tape or butt straps.
      c. Multiple Layered Insulation: Joints staggered.
   2. Access: Items requiring service or maintenance with easily removable and replaceable section of insulation to provide access.
   3. Voids:
      a. Fill voids, chipped corners and other openings with insulating cement or material compatible with insulating material.
      b. In insulation with heat tracing where piping is shown or specified to be heat traced, bed heat tape into heat transfer cement with insulation over heat tape and cement.
   4. Seal joints, seams, and fittings of metal watertight jackets at exterior locations.

B. Fiberglass Insulation: Exterior insulation encased in metal jacket.

C. Calcium Silicate Insulation:
   1. Secure with 18-gauge wire embedded into insulation.
   2. Cover with continuous vapor barrier jacket.

D. Fittings: Insulation specified with continuous vapor barrier, the vapor barrier must not be violated.
   1. Fittings covered with insulation to the same level of the adjoining insulation or fill with insulating cement. Finish with pipe fitting covers or cloth facing and tape.

E. Unions, Mechanical Joints, Valves, Etc.:
   1. General:
      a. As specified for fittings.
      b. Minimum thickness same as specified for piping.
   2. Unions: Build up insulation at least 1/2-inch beyond adjoining insulation.
   3. Flanges: With square corners. Where flanges are not insulated, terminate adjacent insulation so flange bolts can be removed.

4. Flanged Valves: Insulation with square corners.

F. Vapor Barrier Insulation:
   1. Refer to Section 22 0529, Hangers, Supports, and Anchors for Plumbing for support requirements.
   2. Piping which requires vapor barrier protection of continuous vapor barrier, which may not be pierced or broken. The following piping systems require vapor barrier protection:
      a. Domestic cold water.
   3. Vapor Barrier Insulation:
      a. Insulation for pipe requiring vapor barrier protection 1-1/4-inch or smaller, insulation continuous through pipe hangers and rollers.
      b. For pipe 1-1/2-inch and larger, 6-inch section of calcium silicate, same thickness as pipe insulation with continuous vapor barrier jacket at each hanger or roller. Provide pipe shield specified in Section 22 0529, Hangers, Supports, and Anchors for Plumbing.

G. Non-Vapor Barrier Insulation:
   1. Refer to Section 22 0529, Hangers, Supports, and Anchors for Plumbing for support requirements.
   2. At contractor's option, insulation may be interrupted at supports. Butt insulation tight to support.
   3. If contractor elects to continue insulation at supports, installation as specified for piping systems with vapor barrier installation.
   4. Void between saddle and pipe filled with insulation.

3.04 FIELD QUALITY CONTROL

A. Field Test: Test and approve systems prior to installation of insulation.

B. Existing Insulation:
   1. Repair existing insulation damaged during construction.
   2. Make neat connections where new and existing insulation meet.
   3. Where existing piping, or equipment is removed, cover existing surfaces neatly to match existing.

END OF SECTION

SECTION 22 0800

COMMISSIONING FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. The commissioning process is described in Section 01 9100 Commissioning.

B. Provide labor and materials required to complete the commissioning of those Division 22, Plumbing systems and equipment identified as Commissioned Systems and Equipment in Section 01 9100 Commissioning.

1.02 RELATED SECTIONS INCLUDE:

A. Division 01, General Requirements

B. Division 22, Plumbing

C. Section 01 9100 Commissioning

1.03 SUBMITTALS

A. Refer to Section 01 9100 Commissioning.

1.04 COMMISSIONING SCOPE OF WORK - COMMISSIONING AGENT

A. Refer to Section 01 9100 Commissioning.

1.05 COMMISSIONING SCOPE OF WORK - CONTRACTOR

A. Refer to Section 01 9100 Commissioning.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Refer to Section 01 9100 Commissioning.

PART 3 EXECUTION

3.01 MEETINGS

A. Refer to Section 01 9100 Commissioning.

3.02 INSTALLATION, CHECK-OUT, START-UP AND PREFUNCTIONAL CHECKS

A. Refer to Section 01 9100 Commissioning.

3.03 FUNCTIONAL TESTING

A. Refer to Section 01 9100 Commissioning.

3.04 TRAINING OF FACILITY OPERATING STAFF AND BUILDING OCCUPANTS

A. Refer to Section 01 9100 Commissioning.

END OF SECTION

SECTION 22 2113

PIPE AND PIPE FITTINGS PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Cast Iron Soil Pipe, Service Weight (No-Hub)
   2. PVC Pipe (DWV)
   3. ABS Pipe (DWV)
   4. Copper Pipe
   5. PEX Potable Water Tubing
   6. Flanged Joints
   7. Unions
   8. Solder and Brazing
   9. Utility Markers
   10. Pipe Wrapping

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

C. Section 22 0529, Hangers, Supports, and Anchors for Plumbing

D. Section 22 2500, Plumbing Water Treatment

E. Section 22 0523, General Duty Valves for Plumbing

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Piping material and installation to meet requirements of the local plumbing, fire, and building codes and serving utility requirements.
   2. Provide chlorination of domestic cold and hot water piping in accordance with County and State health requirements.

B. Pipe Cleaning: If pipe gets plugged or should foaming of water systems occur, disconnect piping, reclean, and reconnect without additional expense to the Owner.

C. Correct damages to the building or systems resulting from failure to properly clean the system without additional expense to the Owner.

D. Products with a wetted surface installed in potable water systems UL classified in accordance with ANSI / NSF-61 for Drinking Water System components, ANSI/NSF-14 for Plastic Piping System Components and certified to the low lead requirements of NSF-372.

1.04 SUBMITTALS

A. Submit the following:
   1. List of piping materials indicating the service it is being used for. (Do not submit piping product data).
   2. Product data on mechanical couplings and related components, double wall fuel oil pipe and fittings, and polypropylene waste and vent pipe.

B. Test Reports and Certificates: Submit certificates of inspections and pipe tests to Owner.

C. Other: Make certified welders' certificates available.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. As indicated.

2.02 CAST IRON SOIL PIPE, NO-HUB (ABOVE GRADE

A. General: A code approved hubless system conforming to Cast Iron Soil Pipe Institute Standard 301.

B. Pipe and Fittings:
   1. Service weight hubless cast iron conforming to ASTM A 888, marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
   2. Manufacturers:
      a. Tyler
      b. AB&I
      c. Charlotte

C. Gaskets: Compression type conforming to ASTM C 564.

D. Above Grade Couplings: Band type coupling in conformance with Cast Iron Soil Pipe Institute (CISPI) 310-90, consisting of stainless steel clamp, and corrugated shield assemblies with a neoprene sealing sleeve ANSI A21.6, ANSI A21.10 Fittings.
   1. Buried: Husky 28 gauge 304 stainless steel hubless type clamp and orange corrugated shield assemblies (80-inch pound torque) with neoprene sealing gaskets (ASTM-C-564), or Clamp-All (125-inch pound torque), 24 gauge 304 stainless steel hubless type clamp, and shield assemblies with neoprene sealing gaskets (ASTM-C-564).
   2. Service:
      a. Sanitary, storm, and overflow drain.
      b. Vent piping 2 inches and above.

2.03 PVC PIPE – DWV (BELOW GRADE)

A. Pipe: PVC, wall thickness equal to Schedule 40 standard steel pipe, conforming to ASTM D2665-85a.

B. Fittings: PVC building drain, waste, and vent fittings conforming to ASTM D2665-85 and ASTM D3311-82.

C. Solvent Cement: PVC pipe conforming to ASTM D2564-80.

D. Service: Sanitary waste and vent, except not allowed in return air plenums.

2.04 ABS PIPE (DWV) (STORM DRAINAGE ONLY)

A. Pipe: ABS, wall thickness equal to schedule 40 standard steel pipe, conforming to ASTM D2661-85a.

B. Fittings: ABS waste and vent fittings conforming to ASTM D2661-85a and ASTM D3311-82.

C. Solvent Cement: ABS pipe conforming to the requirement of ASTM D2235-81.

D. Service: Sanitary waste and vent, storm and overflow, except not allowed in return air plenums.

2.05 COPPER PIPE

A. Pipe: Hard drawn copper tubing (unless otherwise noted),
   1. Type L, or K: ASTM B 88

B. Fittings:
   1. Wrought copper, 150 psi; ANSI B16.22 for soldered joints, ANSI B16.50 for brazed joints; Chase, Revere, Mueller or approved equal.
   2. System using mechanically extracted collars in main with branch line inserted to not obstruct flow may be used on domestic water piping above ground, similar to T-drill.

C. Service:
   1. Type L:
      a. Domestic Water (above grade)
   2. Type K:
      a. Domestic Water (below grade)
   3. Type DWV: (not to be used on pressure systems)
      a. Drains and overflows (clear, condensate)

2.06 PEX POTABLE WATER TUBING

A. Manufacturers:
   1. Uponor (aka Wirsbo)
   2. Other Manufacturers: Submit substitution request.

B. Regulatory Listings: Submit appropriate NSF International, UL, Warnock Hesey, or CSA listings as proof of compliance with local building and plumbing codes.

C. PEX tubing and components installed in full compliance with local jurisdictional codes, standards, and requirements.

D. Submit listings that indicated that the PEX tubing system has been certified to ANSI/NSF Standards 14 and 61.

E. Quality Assurance:
   1. Installer Qualifications: Installer experienced in performing work of this Section who has specialized in installation of work similar to that required for this project.
   2. Provide in writing to the Owner that the PEX tubing and components furnished under this Section conforms to the material and mechanical requirements specified herein.
   3. Provide letters of certification indicating: Installer uses skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed trades person.

F. Materials:
   1. Tube Materials:
      a. Cross-linked polyethylene (PEX) manufactured by PEX-A or Engle method.
      b. Provide blue colored PEX for cold water systems and red colored PEX for hot water systems for pipe size 1/2-inch thru 1 inch.
   2. Tubing Type:
      a. PEX tubing manufactured in accordance with ASTM F876, ASTM F877 and CAN/CDA-B137.5.
      b. Listed to ASTM by an independent third party agency.
         1) PEX tubing to have Standard Grade hydrostatic design and pressure ratings of 200 degrees F at 80 psi and 180 degrees F at 100 psi. Temperature and pressure ratings issued by the Plastic Pipe Institute (PPI) report TR-4/06.
         2) Minimum bend radius for cold bending of the PEX tubing not less than 6 times the outside diameter. Bends with the radius less than stated requires the use of a bend support as supplied by tube manufacturer.
   3. PEX-a Fittings: elbows, adapters, couplings, plugs, tees and multi-port tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:
      a. UNS No. C69300 Lead-free (LF) Brass.
      b. 20 percent glass-filled polysulfone as specified in ASTM D 6394.
      c. Unreinforced polysulfone (Group 01, Class 1, Grade 2) as specified in ASTM D 6394.
      d. Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D 6394.
      e. Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D 6394.
      f. Reinforcing cold-expansion rings manufactured from the same source as PEX-a piping manufacturer and marked F1960.
   4. Multi-Port Tees: Multiple-outlet fitting complying with ASTM F 877; with ASTM F 1960 inlets and outlets.
      a. Engineered polymer branch multi-port tee.
      b. Engineered polymer flow-through multi-port tee.
      c. Engineered polymer commercial branch multi-port tee.
      d. Engineered polymer commercial branch multi-port elbow.
      e. Engineered polymer commercial flow-through multi-port tee.

5. Manifolds: Multiple-outlet assembly complying with ASTM F 877; with ASTM F 1960 outlets.
    a. Engineered polymer valved manifold.
    b. Engineered polymer valve less manifold.
    c. Lead - free copper branch manifold.
    d. Lead-free copper valved manifold.
6. PEX-to-Metal Transition Fittings:
    a. Manufacturers: Provide fittings from the same manufacturer of the piping.
    b. Threaded Brass to PEX-a Transition: one-piece brass fitting with male or female threaded adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
    c. Brass Sweat to PEX-a Transition: one-piece brass fitting with sweat adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
    d. PEX-a to Flange Transition: two-piece brass fitting with lead-free ProPEX adapter and steel flange conforming to ASME B 16.5.
    e. PEX-to-Thermoplastic Transition Fittings: CPVC to PEX-a Transition: Thermoplastic fitting with one spigot or socket end and one ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

G. Accessories:
1. Wall Penetration Brackets: Brackets designed for wall membrane penetrations supplied by PEX tubing manufacturer; Uponor Drop Ear Bend Support.
2. Concrete Tube Support Brackets: Brackets to hold PEX tubing in place in structural concrete slabs rigid PVC construction and be designed for that purpose.
3. Uponor Stand-Up bracket.

H. Service:
1. Domestic hot and cold-water piping above grade on piping 3 inches and smaller.
2. Trap priming lines below grade.

2.07 UNIONS

A. 150 psi malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing.
1. Unions or flanges for servicing or disconnect are not required in installations using grooved mechanical joint couplings. Couplings serve as disconnect points.

B. Dielectric fittings nationally listed, have a dielectric thermoplastic interior lining, and meet requirements of ASTM F1545. Fittings suitable for the pressure and temperature to be encountered.

2.08 SOLDER AND BRAZING

A. Soldered Joints:
1. Wrought Copper Pipe Fittings: All-State 430 with Duzall Flux, Engelhard Silvabrite with Engelhard General Purpose Flux or J.W. Harris Co.
2. Valves, Cast Fittings or Bronze Fittings: Harris Stay-Silv-15 or Handy & Harmon Sil-Fos.
3. Service:
    a. Above grade copper piping 2-inch and smaller

B. Brazed Joints:
1. Wrought Copper Piping Fittings: Westinghouse Phos-Copper or Dyna-Flow by J.W. Harris Co., Inc.
2. Braze in accordance with Copper Development Association Copper Tube Handbook using BCUP series filler material.
3. Service :
    a. Above grade copper piping larger than 2-inch.

2.09 UTILITY MARKERS

A. Provide plastic tape utility markers over buried piping. Provide identification on tape.

B. Material to be Brady Identoline plastic tape, 6-inch, Seton, or as approved.

PART 3 EXECUTION

3.01 PREPARATION

A. Measurements, Lines and Levels:
   1. Check dimension at the building site and establish lines and levels for work specified in this Section.
   2. Establish inverts, slopes, and manhole elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with Drawings and Specifications.
   3. Use established grid and area lines for locating trenches in relation to building and boundaries.

3.02 EXCAVATION AND BACKFILL

A. General:
   1. Perform necessary excavation and backfill required for the installation of mechanical work in accord with Division 02, Existing Conditions
   2. Repair pipelines or other work damaged during excavation and backfilling.

B. Excavation:
   1. Excavate trenches to the necessary depth and width, removing rocks, roots, and stumps.
   2. Include additional excavation to facilitate utility crossovers, additional offsets, etc.
   3. Excavation material is unclassified. Width of trench adequate for proper installation of piping.
   4. Widen trench if not wide enough for a proper installation.

C. Bedding:
   1. Cast iron, steel, and copper piping full bedded on sand.
   2. Place a minimum 4-inch deep layer on the leveled trench bottom for this purpose.
   3. Remove the sand to the necessary depth for piping bells and couplings to maintain contact of the pipe on the sand for its entire length.
   4. Lay other piping on a smooth level trench bottom so that contact is made for its entire length.

D. Backfill:
   1. Place in layers not exceeding 8 inches deep, and compact to 95 percent of standard proctor maximum density at optimum moisture content.
   2. Earth backfill free of rocks over 2 inches in diameter and foreign matter.
   3. Disposal of excess material as directed.
      a. Interior: Backfill under interior slabs bank sand or pea gravel.
      b. Exterior:
         1) Excavated material may be used outside of buildings at the Contractor's option.
         2) First 4-inches sand, and final 12-inch layer course soil.

3.03 PIPING INSTALLATION

A. Install unions in non-flanged piping connections to apparatus and adjacent to screwed control valves, traps, and appurtenances requiring removal for servicing so located that piping may be disconnected without disturbing the general system.

B. Install piping as to vent and drain. Install according to manufacturer's recommendations.

C. Support piping independently at apparatus so that its weight not carried by the equipment.

D. Run piping clear of tube cleaning or removal/replacement access area on heat exchangers, water heaters, etc.

E. Utility Marking:
   1. Installed over the entire length of the underground piping utilities.
   2. Install plastic tape along both sides and the center line of the trenches at the elevation of approximately 12-inches above the top of utility.

F. Dielectric Fittings:
   1. Provide dielectric couplings, unions, or flanges between dissimilar metals.
   2. Provide dielectric couplings as required to isolate cathodically protected piping and equipment.

G. No-Hub Couplings: Install per manufacturer's instructions.

H. PEX System:
   1. Installation complies with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions for installation.
   2. PEX tubing passing through metal studs provided with grommets or sleeves at the penetration.
   3. Protect PEX tubing with sleeves where abrasion may occur.
   4. Use strike protectors where PEX tubing has the potential for being struck with a screw or nail.

3.04 PIPING JOINTS

A. Pipe and fittings joined using methods and materials recommended by manufacturer in conformance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc. done with proper tools and equipment. Hacksaw pipe cutting prohibited. Peening of welds to stop leaks not permitted.

B. ABS Piping:
   1. Socket weld joints with solvent cement and application method recommended by manufacturer, use power saw and miter box to cut ABS pipe.
   2. Allow proper curing time based on temperature range during cure period before pressure testing.

C.

D. Copper Piping:
   1. Pipe cut evenly with cutter, ream to full inside diameter; end of pipe and inside of fitting thoroughly cleaned and polished.
   2. Joints uniformly heated, and capillary space completely filled with solder or braze material, leaving full bead around entire circumference.

E. No couplings installed in floor or wall sleeves.

F. Above Grade No-Hub Couplings: Install in accordance with manufacturer recommendations.

3.05 ADJUSTING AND CLEANING

A. General:
   1. Clean interior of piping before installation.
   2. Flush sediment out of piping systems after installation before connecting plumbing fixtures to the piping.
   3. When placing the water systems in service during construction, each system cleaned in accordance with Section 22 2500, Plumbing Water Treatment prior to being placed in service.

END OF SECTION

SECTION 22 2123
PUMPS FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. In-Line Circulating Pumps
   2. Sump Pump

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 QUALITY ASSURANCE

A. Select pump impellers such that impellers not greater than minimum impeller size plus 90 percent of the difference between the maximum and minimum impeller size for pump selected.

B. Select motor to be non-overloading under operating conditions.

C. Select pump with a minimum efficiency as listed in schedule.

1.04 SUBMITTALS

A. Submit the following:
   1. Product data for each pump including performance curves, pump efficiency, motor data, operating weights, and pressure ratings. Submit control information and wiring diagrams for packaged equipment.
   2. Operating and maintenance data for each product specified under this Section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In-Line Circulating Pumps:
   1. Taco
   2. Bell and Gossett
   3. Grundfos
   4. Other Manufacturers: Submit substitution request.

B. Sump Pump:
   1. Weil
   2. Paco
   3. Bell & Gossett
   4. Peabody Barnes
   5. Aurora
   6. Other Manufacturers: Submit substitution request.

2.02 IN-LINE CIRCULATING PUMPS

A. Description:
   1. Pipe mounted, integral centrifugal pump and integral motor.
   2. Direct drive.
   3. Casing: Stainless steel
   4. Stainless steel replaceable cartridge.
   5. Ceramic shaft, carbon bearings, EPDM o-rings and gaskets.
   6. Stainless steel, union tappings.
   7. Self-lubricating, no mechanical seal.
   8. Motors:
      a. Permanent split capacitor, impedance protected
      b. Speed as scheduled.

PART 3 EXECUTION

3.01 IN-LINE CIRCULATING PUMP INSTALLATION

A. Motor in horizontal or vertical depending on normal design of pump.

B. Provide valves and specialties as detailed on Drawings.

C. Support and isolate circulators as specified and as scheduled on the Drawings.

D. Pump to be controlled by Building Management System.

3.02 SUMP PUMP

A. Elevator:

1. Description: Packaged sump pump, complete including pump and controls; pump with cast iron body and motor housing, cast iron impeller, mechanical seals, stainless steel shaft and strainer.
2. Controls/Electrical:
   a. Provide float operated controls arranged to allow pump operation and alarm bell initiation.
   b. Furnish complete control unit, including disconnect, starter, TOA selector switch(es), float and high water alarm control with alarm bell, and contacts for remote alarm point pickup.
   c. Package for single point electrical connection including controls.

END OF SECTION

SECTION 22 2500
PLUMBING WATER TREATMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Plumbing Water Treatment

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 SUBMITTALS

A. Submit the following:
   1. Product Data
   2. Operating and Maintenance Data
   3. Certificate of Completion
   4. Treatment Reports

PART 2 PRODUCTS

2.01 MANUFACTURER

A. US Water Services

B. Nalco

C. Mogul

D. Chemax

E. Chemcoa

F. DuBois Chemicals

G. Water Solutions Northwest

H. Or approved equal.

2.02 PLUMBING WATER TREATMENT

A. Domestic Water Chlorination:
   1. Chlorination accomplished by personnel in employed of firm licensed to do this type of work.
   2. Potable water systems disinfected prior to use as outlined within the current state or local Plumbing Code or as prescribed by the Health Authority, whichever requirements are more stringent.
   3. Chemicals: Sodium Hypochlorite 12.5 percent EPA registered for drinking water application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Plumbing Domestic Water Systems:
   1. Flush system with fresh water to remove dirt and construction debris.
   2. Open all fixtures to develop slow rate of flow through system.
   3. Injection Sodium Hypochlorite solution at a rate to achieve greater at 100ppm chlorine at fixtures.
   4. Flush entire system so no chlorine is present.
   5. Submit bacteriological samples to certified laboratory to certify that the water is suitable for drinking. Deliver certificate stating purity of water to the Architect.

3.02 FINAL ADJUSTMENT

A. When the systems are accepted by the Owner the chemical treatment supplier makes final adjustments in the required concentrations.

B. Submit report of indicating initials and final concentrations and system chemistry.

END OF SECTION

SECTION 22 3000

PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Water Heaters
   2. Domestic Water Expansion Tank
   3. Backflow Preventers

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Water heaters to meet state energy code requirements.

1.04 SUBMITTALS

A. Submit the following:
   1. Product data for each item specified.
   2. Operating and Maintenance Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Water Heaters:
   1. Gas Water Heater (Storage Type, Condensing, Direct Vent):
      a. Lochinvar
      b. Other Manufacturers: Submit substitution request.

B. Domestic Water Expansion Tank:
   1. Amtrol
   2. Bell & Gossett
   3. Armstrong
   4. Wheatley
   5. Taco
   6. Or equal.

2.02 WATER HEATERS

A. Gas Water Heater (Storage Type, Condensing, Direct Vent):
   1. General: Provide direct vent type commercial gas-fired storage water heater of sizes, capacities, and efficiencies as indicated on the Drawing Schedules.
      a. Gas water heater constructed of heavy gauge steel with ceramic glass lining applied after the tank is assembled and welded. Coat condensing flue coil on the flue gas side acid resistant glass lining designed for use in condensing heaters.
      b. Insulate tank with foam insulation to comply with ASHRAE 90 standards and local codes, with a baked enamel steel jacket.
      c. ASME pressure and temperature relief valve and ASME rated pressure vessel.
      d. Safety Controls: CSD-1 and as required by current local codes for automatic operation.
      e. Factory install and provide the following:
         1) High Temperature Limiting Device
         2) Drain Valve
         3) Low Water Protective Device
         4) Dielectric Nipples
         5) Flue Baffle
         6) Heat Traps

7) Inlet Dip Tube
8) Suspended Sacrificial Anode Rod

f. UL listed
g. Water heater fully condensing unit with a 90 percent – 98 percent thermal efficiency. Refer to Drawings for efficiency at scheduled operating conditions.
h. Venting: Unit to be suitable for category IV direct venting.
i. Power burner designed so it requires no special calibrations on start up. Heater approved for 0-inch clearances to combustibles.
j. Control integrated solid state temperature and ignition control device with integral diagnostics, LED fault display capability, and a digital display of temperature settings.
k. Equip tanks with an ASME rated temperature pressure relief valve. UL listed water heater and exceed the minimum efficiency requirements of ASHRAE 90.
l. Heater: SCAQMD Rule 1146.2 Low NOx.

B. Backflow Preventers:
1. Watts
2. Febco
3. Wilkins
4. Hersey
5. Apollo
6. Ames
7. Other Manufacturers: Submit substitution request.

2.03 DOMESTIC WATER EXPANSION TANK

A. Diaphragm type of welded steel, constructed for 150 psi working pressure.

B. Heavy-duty butyl diaphragm meets FDA requirements for potable water supply.

C. Pre-charged with compressed air to minimum fill pressures as indicated on the Drawings.

PART 3 EXECUTION

3.01 WATER HEATER INSTALLATION

A. Install per manufacturer's installation instructions and in accordance with all applicable codes.

B. Provide pressure/temperature relief valve on storage tanks. Provide piping from relief valve to floor sink utilizing a 1-inch air gap at discharge point.

C. Support:
1. Install water heater oriented so that controls and devices needing service and maintenance have adequate access.
2. Install water heaters level.
3. Provide required strapping to structure and floor in accordance with code requirements.

D. Water Piping:
1. Provide hot and cold water piping to units with shutoff valves, unions, and specialties as detailed on the Drawings.
2. Provide return piping with shutoff valve, check valve, and union.

3.02 REDUCED PRESSURE BACKFLOW ASSEMBLY (RPBA) TYPE:

1. 2-inch Size and Smaller:
a. Screwed ends with bubble-tight ball valves, bronze main valve body and cover, bronze main valve with stainless steel 316 trim and four test cocks.
b. Maximum working pressure of 150 psi unless scheduled.
2. 2-1/2-inch Size and Larger:
a. Flanged ends with non-rising stem shutoff valves, cast iron main valve body and cover with epoxy coated interior, bronze main valve trim, bronze differential relief valve with stainless steel 316 trim and four test cocks.
b. Maximum working pressure of 150 psi unless scheduled.

END OF SECTION

SECTION 22 4000

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Fixture Trim
   2. Plumbing Fixtures
   3. Drainage Products

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 22, Plumbing

1.03 QUALITY ASSURANCE

A. Water Closets: Maximum Performance (MaP) score of no less than 800

B. Faucets: Certify to NSF/ANSI 61 and California AB1953

1.04 SUBMITTALS

A. Submit the following:
   1. Product data for each item specified.
   2. Operating and Maintenance Data:
      a. Sensor Operated Flush Valves.
   3. Mounting heights for fixtures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers are stated for each fixture specified. The following manufacturers are also acceptable, except when indicated only.

B. Fixture Trim:
   1. Supply Stops:
      a. Chicago
      b. NPT McGuire (LK series)
      c. Brasscraft (SCR series)
   2. Traps:
      a. McGuire
      b. Kenney
      c. Brasscraft

C. Drainage Products and Carrier Products:
   1. J.R. Smith
   2. Josam
   3. Sioux Chief
   4. Zurn
   5. Wade
   6. Watts Drainage
   7. Woodford
   8. Mifab

D. Fixtures:
   1. American Standard
   2. Kohler
   3. Sloan
   4. Toto

E. Seats:
   1. Olsonite
   2. Church
   3. Beneke
   4. Bemis

F. Mixing Valves:
   1. Powers
   2. Leonard
   3. Symmons
   4. Chicago

G. Stainless Steel Products:
   1. Elkay
   2. Just
   3. Franke

H. Shower Controls:
   1. Delta Commercial
   2. Kohler
   3. Symmons
   4. Powers
   5. Moen Commercial

I. Faucets:
   1. Chicago
   2. Delta Commercial
   3. Kohler
   4. Symmons
   5. Moen Commercial

J. Metering Faucets:
   1. Chicago
   2. Symmons

K. Sensor Operated Flush Valves:
   1. Sloan
   2. Zurn

L. Shock Arrestors:
   1. PPP
   2. J.R. Smith

M. Trap Primer Stations:
   1. PPP

N. Grease Interceptor:
   1. Xerxes

O. Exposed Waste and Supply Piping Insulation Kits:
   1. Truebro
   2. McGuire

P. Wash Stations
   1. Bradley
   2. Willoughby

Q. Other Manufacturers: Submit substitution request.

2.02 FIXTURE TRIM

A. Supply Stops: Chicago cast brass rigid riser supplies with loose key angle stops, wall flanges, NPT female inlet, chrome plate finish; equivalent NPT McGuire (LK series), Brasscraft (SCR series), or NPT stops by fixture supplier.

B. Traps:
   1. For floor drains, provide coated cast iron P-trap; recessed, screw jointed or bell and spigot.
   2. For other fixtures, provide 17 gauge, chrome plated cast brass P-Traps with solder bushings, and clean-out.

2.03 PLUMBING FIXTURES

A. WC-1 Water Closet: (Child ADA)
   1. American Standard Baby Devoro 2282001, vitreous china with EverClean, wall hung, elongated bowl, siphon jet action, 1-1/2-inch top spud, white color finish. Complete with Sloan Royal 111-1.28 SMO battery-operated flushometer with metal sensor cover.
   2. Bemis 1600 series white open-front seat, less cover with external check hinge including 300 series stainless steel post and pintles to stop seat at 11 degrees beyond vertical.
   3. J.R. Smith Series 200 chair carrier. Vandal-proof caps.

B. WC-2 Water Closet (Adult ADA):
   1. American Standard Afwall FloWise, vitreous china with EverClean, wall hung, elongated bowl, siphon jet action, 1-1/2-inch top spud, white color finish. Complete with Sloan Royal 111-1.28 SMO battery-operated flushometer with metal sensor cover.
   2. Bemis 1600 series white open-front seat, less cover with external check hinge including 300 series stainless steel post and pintles to stop seat at 11 degrees beyond vertical.
   3. J.R. Smith Series 200 chair carrier.

C. U-1 Urinal:
   1. Kohler Bardon, vitreous china, wall mounted wash down urinal with 3/4-inch top spud, white color finish. Complete with Sloan Sloan Royal 186-0.5 SMO battery-operated flushometer, 0.5 GPF, with metal sensor cover.
   2. J. R. Smith Series 600 floor mounted urinal support. Vandal-proof caps.

D. L-1 Lavatory:
   1. Kohler Kingston 21-1/4-inch by 18-1/8-inch, vitreous china, self-draining deck, backsplash, 4-inch centers, wall hung, concealed arm support, grid drain, white color finish. Holes as required for faucet.
   2. Chicago 802-V665ABCP faucet with polished chrome plated solid brass body construction, 4-inch spout, vandal proof metering push handles, 2.2 gpm pressure compensating aerator, adjustable cycle time closure cartridge, vandal resistant complete. With mixing valve to prevent temperature from exceeding 110 degrees F.

E. L-2 Lavatory (Wash Station)
   1. Bradley EXD-2N: Two faucet wash station, ADA mounting, continuous basin, wall mounted

F. Exposed Waste and Supply Piping Insulation Kits: McGuire Prowrap insulation kit for exposed supplies and waste piping below ADA lavatories and ADA sinks.

G. WS-1 Wash Station (ADA):
   1. Bradley, Model EXD series, 2 station, without soap dispenser, wall-hung, equipped with Chicago 802-V665ABCP- faucets with polished chrome plated solid brass body construction, 4-inch spout, 2-hole, vandal proof metering push handles, 2.2 gpm pressure compensating aerator, adjustable cycle time closure cartridge, vandal resistant complete. With mixing valve to prevent temperature from exceeding 110F.

H. S-1 Sink:
   1. Elkay DRKR3119 , 31-inch by 19-1/2-inch by 7-5/8-inch, single compartment, 18 gauge, Type 304, self-rimming, stainless steel sink; LK35 strainer. Four holes as required: three for faucet and one for LK1141A bubbler valve on opposite end.
   2. Elkay model LK1141A deck mounted, single hole drinking fountain chrome plated solid brass body construction, vandal proof metering push handle, anti-microbial flexible mouth guard.
   3. Chicago 1100-ABCP deck mounted sink faucet, 8-inch centers, L type 8-inch swing spout, 2-inch vandal proof canopy single wing handles, 2.2 gpm pressure compensating aerator, vandal resistant complete.

I. CW-1
   1. Jay R. Smith 2690 Combination Garbage Can Washer and Drain, adjustable spray nozzle centered in the drain
   ~~4.~~**2. Jay R. Smith 3380 Water Supply Control Box for Flushing Rim and Can Washing Drains, integral vacuum breaker, hot and cold water connections, vandal resistant**.

~~I.~~**J.** SH-1 Shower (ADA):
   1. Delta TEK series shower valve assembly with polished chrome finish, pressure balance mixing valve, high temperature limit stop, lever handle, 1.5 gpm hand held shower with two integral check valves and 70-inch hose~~.~~, 24-inch ADA wall/grab bar and R10000 series rough in kit.
   2. J.R. Smith 200 series floor drain with nickel bronze grate.

~~J.~~**K.** LT-1 Laundry Tub:
   1. Fiat FL Series single basin laundry tub, 23-inch by 21-1/2-inch by 13-7/16-inch molded stone with baked enamel angle legs.
   2. Chicago 772 Series faucet with polished chrome plated solid brass body construction, S6 cast swing spout, lever handles, 2.2 GPM flow control outlet.

~~K.~~**L.** Master Mixing Valve:
   1. Leonard Type TM New Generation High Low, exposed, factory tested and assembled mixing valve assembly consisting of but not limited to:
      a. Large and small rough bronze finish thermostatic mixing valves.
      b. High temperature limit stops.
      c. Angle check stops.
      d. Outlet ball valve shutoffs.
      e. Built-in spring check valve with pressure gauges.
      f. Thermometer
      g. Inlet piping manifolds with unions.
   2. Unit to control discharge temperature to ±1 percent.
   3. Mount in locking stainless steel cabinet. See schedule on drawings for capacities.

~~L.~~**M.** Mixing Valve (Point-of-Use):
   1. Leonard 270 series thermostatic point-of-use mixing valve.
   2. ASSE 1070 certified.
   3. Bronze body.
   4. Locked temperature adjustment cap (vandal resistant).
   5. Integral check valves on hot and cold inlets.
   6. Minimum flow 0.5 GPM.
   7. Maximum flow 3.5 GPM at 5 PSI loss.

~~M.~~**N.** SB-1 Supply Box:
   1. Sioux Chief 696 Series washing machine supply box with bottom valve supplies, integral shock arresters, and 2-inch drain outlet.

2.04 DRAINAGE PRODUCTS

A. HB-1 Hose Bibb: WOODFORD Model 67, chrome-plated, removable key, 3/4-inch hose thread, integral vacuum breaker. Freeze proof.

B. HB-2 Water Supply Control Box (Can Washer), J.R. Smith 3380 Series, hot and cold supply, integral stops, vandal resistant. Provide with heat tracing.

C. WH-1 Wall Hydrant: J.R. Smith 5609 Series, bronze finish, removable key, 3/4-inch hose thread, integral vacuum breaker, freeze proof.

D. RD-1 Roof Drain: J.R. Smith 1010 Series, 16-inch low profile diameter dome, cast iron body with combined flashing clamp and gravel stop, no-hub outlet, under deck clamp.

E. OD-1 Overflow Roof Drain: J.R. Smith 1080 Series, 16-inch low profile diameter dome, 2-inch water dam, cast iron body with combined flashing clamp and gravel stop, no-hub outlet and under deck clamp.

F. FD-1 Floor Drain: J.R. Smith 2005 Series, round nickel bronze vandal resistant grate, cast iron body with flashing collar and adjustable strainer head and no-hub outlet.

G. FD-2 Floor Drain (Unfinished Areas): J.R. Smith 2110 Series, round cast iron grate, cast iron body, no-hub outlet, sediment bucket.

H. FS-1 Floor Sink (mechanical room indirect waste): J.R. Smith 3041 Series floor sink with 8-inch deep receptor, basket strainer, 1/2 cast iron grate, no-hub outlet and flashing collar.

I. WCO Wall Cleanout: J.R. Smith 4530 Series, round stainless steel vandal resistant cover and screw.

J. FCO Floor Cleanout: J.R. Smith 4020 Series, round vandal resistant, nickel bronze top.

K. CTG Cleanout to Grade: J.R. Smith 4220 Series, round, extra heavy duty cast iron top set in 12-inch by 12-inch by 4-inch deep concrete pad, vandal resistant.

L. DSB-1 Downspout Boot: J.R. Smith 1787 Series, 4-inch round downspout connection with cleanout.

M. Trap Priming Valves (TP-1):
   1. Precision Plumbing Products Prime-Rite pressure drop activated trap primer to serve up to 2 floor drains/sinks.

N. Grease Interceptor:
   1. Xerxes ZCL Series for underground exterior installation, unit manufactured in compliance with ASME Standard A112.14.3, gravity type, extension sections as required based on installed depth. 1/4-inch thick steel tread plate cover.
   2. See schedule on Drawings for capacity of unit.

O. Water Hammer Arrester: Precision Plumbing Products Model SC (Maintenance-Free).

PART 3 EXECUTION

3.01 FIXTURE TRIM

A. Provide plumbing fixture trim where applicable on fixtures, including but not limited to supply stops, traps, support rims, flush valve, and vacuum breakers.

B. Provide rough-in and final piping connection to fixtures. Carefully review all construction documents to assure that all fixtures are provided with necessary services for a complete operating system.

C. Rigidly secure rough-in piping, carriers and supports, and other service piping to structure.

3.02 PLUMBING FIXTURES

A. Americans with Disabilities Act:
   1. Those fixtures indicated by ADA complies with and be installed in accordance with Americans with Disabilities Act Guidelines (ADAAG). Where applicable building code requirements are more stringent than ADAAG guidelines, building code requirements followed.
   2. Water Closets:
      a. Mounting height of ADA water closet 17-inches to 19-inches from floor to top of the toilet seat.
      b. Mount flush valve for ADA water closets on wide side of enclosure.

3. Lavatories:
    a. Mounting height of ADA lavatories at a maximum height of 34 inches from floor to rim.
    b. Provide insulation kits on exposed hot water and waste piping beneath ADA lavatories.
4. Sinks: Provide insulation kits on exposed hot water and waste piping beneath ADA sinks.
5. Urinals: Mounting height of ADA water closet at a maximum height of 17-inches from floor to top rim.

B. Fixture Mounting Heights: Fixtures standard rough-in catalogued heights unless shown otherwise on the Architectural Drawings.

C. Water Supplies: When both hot and cold water to a fixture is required, connect the hot on the left and the cold on the right.

D. Floor Mounted Supports and Chair Carriers:
1. Secure floor mounted supports and chair carriers to slab with a minimum of 1/2-inch bolts.
2. Install supports and carriers per manufacturer's installation instructions.

E. Lavatories:
1. Public Toilet Room: Grid strainers.
2. Those lavatories indicated as ADA are ADA compatible. Coordinate with Architect to verify if all wall hung lavatories are to be installed at ADA height.

F. Floor Drain and Floor Sinks:
1. Set top flush with finished floor.
2. Provide flashing clamp for all drain bodies installed in floors provided with waterproof membranes.

G. Cleanout:
1. Where shown or required.
2. Cover set flush with finished surface.

H. Roof Drains:
1. Provide sump receivers for all drains except poured in place installations.
2. Provide extension section as required to compensate for the specified insulation thickness above the roof slab or deck.

I. Water Hammer Arresters: Provide where shown and where recommended by Plumbing Drainage Institute (PDI).

J. Mixing Valves: Provide piping connections per manufacturer's installation instructions.

3.03 PRIMING VALVES

A. All floor drains, floor sinks, and similar traps primed. Use minimum 3/8-inch type K annealed copper tubing or PEX. Primer line to be continuous and without joints.

B. Where priming valves are installed in finished rooms, conceal in wall and provide access panel.

END OF SECTION

SECTION 23 0500

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. The intent of Division 23, HVAC Specifications and the accompanying Drawings is to provide a complete and workable facility with complete systems as shown, specified and required by applicable codes. Include work specified in Division 23, HVAC and shown on the accompanying Drawings, including appurtenances, connections, etc., in the finished job.

B. The Drawings that accompany the Division 23, HVAC Specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Offsets and transitions assumed at a minimum at each duct crossing, structural penetrations through shear walls or beams, structural grids where ceiling heights are restricted, and at piping mains. Follow the Drawing as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the Building, subject to approval, and without additional cost to the Owner. The right is reserved to make any reasonable changes in outlet location prior to roughing-in, without cost impact.

C. The General and Supplemental Conditions apply to this Division, including but not limited to:

1. Drawings and specifications.
2. Public ordinances, permits.
3. Include payments and fees required by governing authorities for work of this Division.

D. Division 01, General Requirements, General Requirements, applies to this Division.

1.2 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Products and equipment prohibited from containing pentabrominated, octabrominated, and decabrominated diphenyl ethers. Where products or equipment within this specification contain these banned substances, provide complying products and equipment from approved manufacturers with equal performance characteristics.
2. General: Work and materials conforms to the local and State codes, and Federal, State and other applicable laws and regulations.
3. Contractor responsible for obtaining and payment for permits, licenses, and inspection certificates required in accordance with provisions of Contract Documents.

B. New materials and equipment. Work of good quality, free of faults and defects and in conformance with the Contract Documents.

C. Apparatus built and installed to deliver its full rated capacity at the efficiency for which it was designed.

D. The entire mechanical system and apparatus operates at full capacity without objectionable noise or vibration.

E. Install equipment level and true. Housekeeping pads and curbs account for floor or roof slope.

F. Materials and Equipment:

1. Each piece of equipment furnished meet detailed requirements of the Drawings and Specifications and suitable for the installation shown. Equipment not meeting requirements will not be acceptable, even though specified by name along with other manufacturers.
2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of same manufacturer.
3. Furnish materials and equipment of size, make, type, and quality herein specified.
4. Equipment scheduled by performance or model number considered the basis of the design. If other specified manufacturer's equipment is provided in lieu of the basis of design equipment the contractor is responsible for changes and costs which may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements, or any other differences which impact the project.

G. Workmanship:

1. General: Install materials in a neat and professional manner.
2. Manufacturer’s Instructions:
   a. Follow manufacturer’s directions where they cover points not specifically indicated.
   b. If conflict with the Drawings and Division 23, HVAC Specifications, obtain clarification before starting work.

H. Cutting and Patching:

1. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting performed by skilled craftsmen of each respective trade in conformance with the appropriate Division of Work.
2. Additional openings required in building construction made by drilling or cutting. Use of jackhammer is specifically prohibited.
3. Fill holes which are cut oversize so that a tight fit is obtained around the sleeves passing through.
4. Do no pierce beams or columns without permission of Architect and then only as directed.
5. Restore new or existing work cut or damaged to its original condition. Where alterations disturb lawns, paving, walks, etc., surfaces repaired, refinished, and left in condition existing prior to commencement of work.

1.4 SUBMITTALS

A. Shop Drawings:

1. The Contract Drawings indicate the general layout of the piping, ductwork, and various items of equipment. Coordination with other trades and with field conditions will be required. For this purpose, prepare Shop Drawings of piping, ductwork, and equipment installations. Shop Drawings new drawings prepared by Contractor and not reproductions or tracings of Architect’s Drawings. Overlay drawings with shop drawings of other trades and check for conflicts. Drawings the same size as Architect’s Drawings with title block similar to Contract Drawings and identifying Architect’s Drawing number or any reference drawings. Drawings fully dimensioned including both plan and elevation dimensions. Shop drawings cannot be used to make scope changes.
2. Prepare in three-dimensional format.

3. Include but are not limited to:
    a. Complete floor plans with sheet metal and HVAC piping to a minimum of 1/4-inch equals 1-foot scale.
    b. Sheet metal and HVAC piping of mechanical and fan rooms to a minimum of 1/2-inch equals 1-foot scale.
    c. Sections of congested areas to a minimum of 1/2-inch equals 1-foot scale.
    d. Controls and Instrumentation: Scale and drawing sizes to suit controls supplier.
    e. Fabricated Equipment: Scale and drawing sizes to suit contractor except equipment not less than 1/4-inch equals 1-foot scale.
    f. Superplot plans of above ground work with a colored overlay of trades including, but not limited to, HVAC piping, HVAC equipment, plumbing piping and equipment, sprinklers, lighting, lighting controls, cable tray, fire alarm devices, electrical power conduit, and ceiling system to a minimum of 1/2-inch equals 1-foot scale.
    g. Beam penetration drawings indicating beam penetrations meeting the requirements indicated on the floor plans and on the structural drawings to a minimum of 1/4-inch equals 1-foot scale.
    h. Slab penetration drawings of HVAC, plumbing, sprinklers, lighting and electrical to a minimum of 1/4-inch equals 1-foot scale.
4. Submit shop drawings for review prior to beginning fabrication. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field or when there is a question as to whether contract documents are being complied with or the design intent is being met.

B. Product Data:
1. In general, submit product data for review on scheduled pieces of equipment, on equipment requiring electrical connections or connections by other trades, and as required by each specification section or by Drawing notes. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures, and similar data. Manufacturer's abbreviations or codes are not acceptable.
2. List the name of the motor manufacturer and service factor for each piece of equipment.
3. Indicate equipment operating weights including bases and weight distribution at support points.
4. In the case of equipment such as wiring devices, time switches, valves, etc., specified by specific catalog number, a statement of conformance will suffice.

C. Submission Requirements:
1. Shop Drawings and Product Data:
    a. Refer to Division 01, General Requirements for additional requirements related to submittals.
    b. Submit electronic copies of shop drawings and product data for Work of Division 23, HVAC in PDF format with each item filed under a folder and labeled with its respective specification section number, Article and paragraph and mark if applicable.
    c. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.

d. The bulk of the shop drawings and product data, excepting Controls and Instrumentation, included with the original submittal. Controls and Instrumentation submittals may lag but complete when submitted. Partial submittals will not be accepted. Other stragglers submitted after return of the original binder includes a tab similar to that originally submitted. Upon receipt of the returned late submittal, insert them in the previously submitted binder.

D. Contractor Responsibilities:

1. Submit submittals one time and are in proper order.
2. Ensure that equipment will fit in the space provided.
3. Assure that deviations from Drawings and Specifications are specifically noted in the submittals. Failure to comply will void review automatically.

1.5 AS-BUILT DRAWINGS

A. Provide 3D model and record drawings at the end of the project on USB storage device.

B. 3D model in the following format:

1. AutoCAD
2. Revit
3. Navisworks

C. Record Drawings: Provide hard copies and pdf format.

1. Drawings include the following:
   a. Project Specific Titleblock.
   b. Notations reflecting the as built conditions of any additions to or variations from the construction documents provided as part of the BIM coordination, RFIs, ASIs, Owner Changes, and Field Coordination.

1.6 OPERATING AND MAINTENANCE MANUAL, PARTS LISTS, AND OWNER'S INSTRUCTIONS

A. Refer to Division 01, General Requirements for additional requirements.

B. Submit three bound copies of manufacturer's operation and maintenance instruction manuals and parts lists for each piece of equipment or item requiring servicing. Literature on 8-1/2-inch by 11-inch sheets or catalogs suitable for side binding. Submit data when the work is substantially complete, packaged separately, and clearly identified in durable 3-ring binder. Include name and contact information for location of source parts and service for each piece of equipment. Clearly mark and label in each submittal, the piece of equipment provided with the proper nameplate and model number identified. Provide wiring diagrams for electrically powered equipment.

C. Instruct Owner thoroughly in proper operation of equipment and systems, in accordance with manufacturer's instruction manuals. Operating instructions cover phases of control.

D. Furnish competent engineer knowledgeable in this building system for minimum of five 8-hour days to instruct Owner in operation and maintenance of systems and equipment. Keep a log of this instruction including dates, times, subjects, and those present and present such log when requested by Architect.

1.7 PROJECT CONDITIONS

A. Existing Conditions:

1. Prior to bidding, verify and become familiar with existing conditions by visiting the site, and include factors which may affect the execution of this Work.
2. Include related costs in the initial bid proposal.

B. Coordinate exact requirements governed by actual job conditions. Check information and report discrepancies before fabricating work. Report changes in time to avoid unnecessary work.

C. Coordinate shutdown and start-up of existing, temporary, and new systems and utilities. Notify Owner, the City, and Utility Company.

1.8 WARRANTY

A. Provide a written guaranty covering the work of this Division (for a period of one calendar year from the date of acceptance by the Owner) as required by the General Conditions.

B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of Owner acceptance of Work of this Division.

C. Correct warranty items promptly upon notification.

1.9 PROVISIONS FOR LARGE EQUIPMENT

A. Make provisions for the necessary openings in building to allow for admittance of equipment.

1.10 TEST REPORTS AND CERTIFICATES

A. Submit one copy of test reports and certificates specified herein to the Architect.

1.11 SUBSTITUTIONS

A. Submit requests for product substitutions in accordance with the Instructions to Bidders and the General and Supplemental Conditions.

PART 2 PRODUCTS

2.1 ACCESS PANELS

A. Furnish under this Division as specified in another Division of work.

2.2 PIPE AND DUCT SLEEVES

A. Interior Wall and Floor Sleeves: 18 gauge galvanized steel, or another pre-approved system.

B. Interior Wall and Floor Sleeves (fire rated): Fire rated and water tight system approved by Authority Having Jurisdiction and Owners Insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping material, size and service.

C. Exterior Wall Sleeves: Cast iron

D. On Grade Floor Sleeves: Same as exterior wall sleeves.

E. Water Tight Sleeves: Combination steel pipe sleeves with water stop and anchor plate; Link Seal Model WS, mated with synthetic rubber links interlocked with bolts and nuts; Link Seal Model LS.

2.3 FLOOR, WALL AND CEILING PLATES

A. Furnish stamped split type plates as follows:

1. Floor Plates: Cast brass, chromium plated.
2. Wall and Ceiling Plates: Spun aluminum.

2.4 MACHINERY GUARDS

A. Furnish guards for protection on rotating and moving parts of equipment. Provide guards for metal fan drives and motor pulleys, regardless of being enclosed in a metal cabinet.

B. Design guards so as not to restrict air flow at fan inlets resulting in reduced capacity.

C. Provide shaft holes in guards for easy use of tachometers at pulley centers. Guards easily removable for pulley adjustment or removal and changing of belts.

D. Guards meet OSHA requirements including back plates.

E. Provide inlet and outlet screens on fans in plenums or where exposed to personnel.

2.5 ELECTRICAL EQUIPMENT

A. General: Equipment and installed work as specified under Division 26, Electrical.

B. Coordinate with the electrical Drawings and electrical contractor for minimum electrical equipment bracing requirements based on the available fault current rating at the bus of the panelboard or switchboard serving the piece of equipment. Provide equipment with a Short Circuit Current Rating (SCCR) that meets the bracing requirement.

C. Motors – AC Induction:

1. Furnish as integral part of driven equipment.
2. Drip proof induction type with ball bearings unless noted otherwise.
3. Motors 1 hp and above premium energy efficient type, except for emergency equipment motors.
4. Built to NEMA Standards for the service intended.
5. Rated for voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage.
6. Energy Efficient Motors:
   a. Baldor
   b. Westinghouse
   c. General Electric
   d. Or approved equal.
7. Motors meet the efficiency standards identified in the table below as determined using the IEEE Method B test at full load.

MINIMUM MOTOR EFFICIENCIES					
		RPM IEEE 112B Efficiency			
HP	KW	900	1200	1800	3600
1	0.75	--	82.5	85.5	80.0
1.5	1.15	--	86.5	86.5	85.5
2	1.53	--	87.5	86.5	86.5
3	2.3	84.0	89.5	89.5	88.5
5	3.8	85.5	89.5	89.5	89.5
7.5	5.6	87.5	91.7	91.7	91.0
10	7.5	88.5	91.7	91.7	91.7
15	7.5	88.5	91.7	92.4	91.7
20	15.9	90.2	92.4	93.0	92.4
25	18.8	91.0	93.0	93.6	93.0
30	22.5	91.0	93.6	94.1	93.0
40	30.0	91.7	94.1	94.5	93.6

8. Refer to Equipment Schedules on the Drawings for motor horsepower, voltage, and phase.
9. Refer to individual product sections for additional motor requirements.
10. Furnish motors on belt drive equipment of nominal nameplate horsepower not less than 120 percent of equipment brake horsepower required for performance specified.
11. Built-in thermal overload protection, or be protected externally with separate thermal overload devices with low voltage release or lockout. Hermetically sealed motors have quick trip devices.
12. Motors controlled by variable frequency drives inverter duty rated and have Class F insulation or better. Withstand repeated voltage peaks of 1600V with rise times of 0.1 microseconds and greater in accordance with NEMA Standard MG1 Part 31.
13. Motors served from variable frequency drives equipped with shaft grounding system which provide a path for current to flow between the shaft and motor frame. SGS or equal.

14. Motors located in environment air plenums not tied to air handling functions totally enclosed type motors.

D. Motors – Electronic Commutation (EC):

1. Furnished as integral part of driven equipment.
2. Permanently lubricated with ball bearings unless noted otherwise.
3. Internal motor circuitry converts AC power supplied to the motor to DC power to operate the motor.
4. Speed controllable down to 20 percent of full speed.
5. Motor efficiency at a minimum of 85 percent at all speeds.
6. Refer to Equipment Schedules on the Drawings for motor horsepower, voltage, and phase.
7. Refer to individual product sections for additional motor requirements.
8. Built-in thermal overload protection, or be protected externally with separate thermal overload devices with low voltage release or lockout. Quick trip devices hermetically sealed motors.
9. Motors located in environment air plenums not tied to air handling functions totally enclosed type motors.

E. Starters: Provided under Division 26, Electrical, suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.

F. Equipment Wiring:

1. Interconnecting wiring within or on a piece of mechanical equipment provided with the equipment unless shown otherwise.
2. This does not include the wiring of motors, starters and controllers provided under Division 26, Electrical.

G. Control Wiring: Control wiring for mechanical equipment provided under Section 23 0900, Instrumentation and Controls for HVAC.

H. Codes: Electrical equipment and products bear the UL label as required by governing codes and ordinances.

PART 3 EXECUTION

3.1 ACCESS PANELS

A. Install in accord with manufacturer’s recommendations, coordinated with architectural features.

B. Provide 2-hour fire rated doors where required bearing the UL label.

C. Furnish 18-inch by 18-inch panels for ceilings and for access to equipment in soffits and shafts, and 12-inch by 12-inch for walls unless indicated otherwise.

D. Furnish where indicated and where required to access valves, fire/smoke dampers, trap primers, shock arresters, and other appurtenances requiring operation, service or maintenance. Submit proposed locations for review prior to installation.

3.2 SLEEVES

A. Interior Floor and Wall Sleeves:

1. Provide sleeves large enough to provide 3/4-inch clearances around pipe or ductwork.
2. Where pipe or ductwork is insulated, provide sleeve large enough to provide 3/4-inch clearance around insulation. Maintain continuous insulation as it passes through sleeve.

3. Penetrations through mechanical room and fan room floors watertight by packing with safing insulation and sealing with Tremco Dymeric Sealant or approved system.

B. Sleeves through Rated Floors and Walls: Similar to interior sleeves except install fire rated system approved by Authority Having Jurisdiction and Owners insurance underwriter, with rating equal to floor or wall penetration, and designed specifically for the floor or wall construction, piping or duct material, size and service.

C. Sleeves specified or indicated at fire damper penetrations take precedence over this article.

D. Exterior Wall Sleeves Below Grade:

1. Provide water tight sleeves. Install at pipes entering building below grade and where shown.

2. Adjust to provide positive hydrostatic seal.

3. Follow manufacturer's procedure for installing and tightening seal.

4. Secure sleeves against displacement.

E. On Grade Floor Sleeves: Same as below grade exterior wall sleeves, caulked from inside.

F. Exterior Wall Sleeves Above Grade: Similar to interior wall sleeves except caulk outside with Tremco Dymeric Sealant.

G. Layout work prior to concrete forming. Do cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.

H. Floor sleeves maintain a water barrier by providing a water tight seal or they extend 1-inch above finished floor except through mechanical equipment room floors and shafts where sleeves extend 2-inches above finished floor level. Sleeves through roof extend 8-inches above roof. Wall sleeves flush with face of wall unless otherwise indicated.

I. Do not support pipes by resting pipe clamps on floor sleeves. Supplementary members provided so pipes are floor supported.

J. Special sleeves detailed on drawings take precedence over this section.

3.3 CLEANING

A. General: Clean mechanical equipment, piping and ductwork of stampings and markings (except those required by codes), iron cuttings, and other refuse.

B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

C. Additional requirements are specified under specific Sections of this Division.

3.4 EQUIPMENT PROTECTION

A. Keep pipe, ductwork, and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, ductwork, equipment, and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment, or apparatus to original conditions or replace at no cost to the Owner.

B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.

C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.5 ACCESSIBILITY

A. General: Locate valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs, and removal or replacement conveniently and accessibly with reference to the finished building.

B. Thermometers and Gauges: Install thermometers and gauges so as to be easily read from the floors, platforms, and walkways.

3.6 FLOOR, WALL, AND CEILING PLATES

A. Install on piping and ductwork passing through finished walls, floors, ceilings, partitions, and plaster furrings. Plates completely cover opening around pipe and duct.

B. Secure wall and ceiling plates to pipe, insulation, or structure.

C. Plates not penetrate insulation vapor barriers.

D. Plates not required in mechanical rooms or unfinished spaces.

3.7 PAINTING

A. General:

1. Coordinate painting of mechanical equipment and items with products and methods in conformance with the appropriate Division of Work, Painting.
2. Exposed work under this Division receives either a factory painted finish or a field prime coat finish, except:
    a. Exposed copper piping.
    b. Aluminum jacketed outdoor insulated piping.

B. Equipment Rooms and Finished Areas:

1. Insulation: Not painted.
2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, and Equipment Bases: Paint one coat of black enamel.
3. Steel Valve Bodies and Bonnets: One coat of black enamel.
4. Brass Valve Bodies: Not painted.
5. Equipment:
    a. One coat of grey machinery enamel.
    b. Do not paint nameplates.
6. Grilles, Diffusers, Registers: Paint sheet metal and visible ductwork behind grilles, diffusers, and registers flat black.

C. Concealed Spaces (above ceilings, not visible):

1. Insulation: Not painted.
2. Do not paint the following:
    a. Hangers
    b. Uninsulated Piping
    c. Miscellaneous Iron Work
    d. Valve Bodies and Bonnets

D. Exterior Steel: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel.

E. Exterior Black Steel Pipe:

1. Wire brush and apply two coats of rust-inhibiting primer and one coat of exterior enamel.
2. Painting schemes comply with ANSI A13.1.

3.8 ADJUSTING AND CLEANING

A. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.

B. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment as approved or replace with new equipment.

3.9 ELECTRICAL EQUIPMENT

A. Ductwork or piping for mechanical systems not serving electrical space not installed in any switchgear room, transformer vault, telephone room, or electric closet except as indicated.

B. Ductwork or piping for mechanical systems not to pass over switchboards or electrical panelboards. Where conflicts exist, bring to attention of Architect.

3.10 EQUIPMENT CONNECTIONS

A. Make final connections to equipment specified in sections other than Division 23, HVAC of the specifications and Owner furnished equipment in accordance with manufacturer's instructions and shop drawings furnished and as indicated.

B. Piping:

1. Provide valves and specialties as specified and as detailed on the Drawings. Provide increasers, reducers, and any other fittings required for complete installation.

2. Independently support piping connections supported to prevent undue strain on equipment.

C. Ductwork: Make exhaust connections to fume hoods, emergency generator radiators, and any other processing, laboratory, or kitchen equipment in strict accordance with manufacturer's instructions.

D. Refer to Division 11, Equipment for requirements.

END OF SECTION

SECTION 23 0514

VARIABLE FREQUENCY DRIVES FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Variable Frequency Drives

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0900, Controls

1.03 SUBMITTALS

A. Submit the following:
   1. Product data on variable frequency drives and related components.
   2. Startup log/check list showing successful operation.
   3. Operation and maintenance data.

1.04 WARRANTIES

A. Provide 24-month warranty from date of shipment to include full replacement covering parts and labor.

PART 2 PRODUCTS

2.01 VARIABLE FREQUENCY DRIVES

A. Manufacturers:
   1. Reliance
   2. Toshiba
   3. ABB
   4. Emerson
   5. Yaskawa
   6. Square D
   7. Siemens
   8. Saftronics
   9. Allen-Bradley
   10. Danfoss
   11. Cerus
   12. Other Manufacturers: Submit substitution request.

B. General Description:
   1. Variable Frequency AC Motor Drive (VFD):
      a. Pulse width modulated (PWM) inverter type.
      b. Designed to convert 60 Hz input power to adjustable frequency output power to provide positive speed control to standard induction motors.
      c. Dedicated variable torque design for specific use with centrifugal loads.
   2. Provide completely solid state variable frequency power and logic unit.
   3. Speed control to be stepless throughout the range under variable torque load on continuous basis. Speed controlled by remote building energy management system providing 4-20MA input signal to drive and remote start/stop signal. Coordinate with Section 23 0900, Instrumentation.
   4. Provide adjustable frequency control with diode bridge/capacity input designed to provide high, constant power factor of 0.95 regardless of load or speed and eliminate SCR line noise.

5. Equipment will be designed and manufactured in accordance with applicable current NEMA and IEEE recommendations and be designed for installation per NEC. Equipment will be UL listed and bear the UL label.
6. Control suitable for operation in ambient temperatures of 32 degrees F to 104 degrees F.
7. Factory tested with an AC induction motor 100 percent loaded and temperature cycled within an environmental chamber at 104 degrees F.

C. Self-Protection and Reliability Features:
1. Adjustable current limit to 60 percent to 110 percent of drive rating.
2. Adjustable instantaneous overcurrent trip.
3. Under voltage trip.
4. Over temperature trip.
5. Short circuit protection phase to phase and phase to ground faults phase rotation insensitive.
6. Momentary power loss, more than 17 milliseconds.
7. Transient protection against normal transients and surges in incoming power line.
8. Orderly shutdown in event of any of above conditions, drive designed to shut down safely without component failure.
9. Provide visual indication and manual reset.

D. Standard Features:
1. Drive Logic: Microprocessor based
2. Control Logic: Isolated from power circuitry.
3. Standalone operation to facilitate start up and troubleshooting procedures.
4. UL 508C listed for drives serving a single motor or UL 508A listed for drives serving multiple motors, for use on distribution systems with 22,000 AIC.
5. Output voltages equal to applied input voltage.
6. Isolated signal inputs.
7. Frequency Stability. Output frequency will be held to +0.1 percent of maximum frequency regardless of load, +10 percent input voltage change or temperature changes within ambient specification.
8. Built-in digital display indicates output frequency, voltage, and current and provide indication of over current, over voltage, current limit, ground fault, over temperature, input power on, minimum or maximum speed adjustment, power on, fault condition. Display on panel face.
9. Start/Stop Control - Controlled decelerated stop.
10. Primary and secondary fused for a control circuit transformer.
11. Minimum and maximum speed control.
12. Adjustable Accel/Decel - independently adjustable 10-100 second.
13. Hand-Off auto switches.
14. Programmable Auto Restart - after power outage.
15. Provide fused disconnect, including auxiliary contacts to isolate control circuit when disconnect is in “off” position, except fused disconnects not required where packaged equipment is provided with a single point connection with single point disconnect and internal overcurrent protection for VFD and motors.
16. Remote contacts for fault, and on/off status.
17. Adjustable motor output voltage.
18. Analog output voltage of 0-10 VDC, -20 MA proportional to control output frequency.
19. Provide a NEMA 1 enclosure for indoor applications and NEMA 3R enclosure for outdoor applications to isolate each motor starter and control section with its associated disconnect switch.
20. Manual speed control for each motor.
21. Manual bypass (3 contactor) to provide ability to service control while motor is operational.
22. Provide RF, and EMI, noise suppression network to limit RF and EM interference.
23. Provide isolated analog output signals for volts, amps, and frequency, from each VFD for connection to the building energy management system.

24. Provide line (input) reactors.
25. Provide output filters for VFD's located more than 25 conductor feet from the motor they serve. Output reactors permit VFD's to be located up to 350-feet from the motors they serve.
26. Design VFD to catch spinning load in forward and reverse direction.
27. Harmonic Calculations: Perform on manufacturer supplied Harmonic Analysis program to provide conformance with IEEE 519-1992.

E. Communications:
1. Provide factory installed communication chip for direct network connection to DDC Control System specified in Section 23 0900, Instrumentation and Controls for HVAC. Interface allows for control and interface functions specified herein and in Section 23 0900, Instrumentation and Controls for HVAC. Interface control functions and information includes, but not be limited to the following:
   a. Start/Stop
   b. Change Directions
   c. Drive Fault
   d. Drive Fault Codes
   e. Reset Drive
   f. Percent Output
   g. Speed
   h. Power
   i. Drive Temp
   j. KWH
   k. Run Time
2. Provide isolated analog output signals for volts, amps and frequency from each VFD for connection to the DDC Control System specified in Section 23 0900, Instrumentation and Controls for HVAC.
3. Provide RS485 communications port and programming software capability.

PART 3 EXECUTION

3.01 VARIABLE FREQUENCY DRIVE INSTALLATION

A. Install VFD in accordance with manufacturer's written installation instructions.

B. Install on strut support stand.

C. Provide one drive for each motor as scheduled.

3.02 START UP

A. General: Comply with manufacturer's instructions for startup.

B. Provide under direct supervision of the manufacturer's representative with factory trained personnel.

3.03 FIELD QUALITY CONTROL

A. Prior to installation, manufacturer's representative coordinate variable speed drive control interface with the controls contractor and verify that intended installation (controls, wiring, etc.) complies with the manufacturer's recommendations.

B. Field Test: Except where initial variable speed drive operation clearly shows the performance meets or exceeds the requirements, test to show compliance. Tests performed by the manufacturer's representative in the presence of the Engineer.

3.04 COMMISIONING

A. Subsequent to completion of commissioning process, provide written programming parameters along with electronic copy to Owner to ensure that replacement drives may be identically programmed.

END OF SECTION

SECTION 23 0518

HVAC EXPANSION COMPENSATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. The provisions of Division 23, Heating, Ventilation and Air Conditioning (HVAC) Section 23 0500, Common Work Results for HVAC, apply to work specified in this Section.

1.02 SUMMARY

A. This Section includes Design-Build work.

B. This Section includes:
   1. Expansion Joints and Compensators
   2. Expansion Loops/Seismic Expansion Joints

1.03 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0529, Hangers, Supports and Anchors for HVAC

D. Section 23 0548, Vibration and Seismic Controls for HVAC Piping and Equipment

E. Section 23 2113, Pipe and Pipe Fittings HVAC

1.04 QUALITY ASSURANCE

A. Design expansion joints, pipe guides, and related supports, braces, and anchorages to building structure to absorb thermal expansion and contraction of piping and terminal movement, as well as to resist the static and dynamic loads due to fluid flow at design conditions, hydraulic testing pressures, and seismic forces.

B. Expansion Joints, Guides, and Related Supports, Braces, and Anchorage to Building Structure: Provide design and details bearing the seal of a professional engineer registered in the State having jurisdiction.

C. Use expansion joints in straight lengths of rigid pipe anchored and guided in accordance with best practices recommendations of ASHRAE and ASME B31.9.

D. Avoid use of expansion joints in conjunction with U-bends or other piping systems with inherent flexibility, such as piping with flexible mechanical couplings.
   1. If expansion joints are used in piping with bends, conduct thorough analysis of pipe stresses and deflections with extra care and attention paid to radial thrust capacity of pipe guides, braces, and anchors.

E. Design to include:
   1. Pipe stress analysis indicating loads, deflections, and pipe stress at critical points throughout the piping systems under the following conditions:
      a. At hydraulic design test pressure and ambient water temperature.
      b. At design operating temperature, pressure, and flow.
      c. At design occasional seismic loads where required by the building occupancy and risk category as defined in the state and local code or by the authority having jurisdiction.
      d. Model number, size, location, and details of expansion joints, compensator guides, supports, braces, and anchorage to building structure, with substantiating calculations that the components and building can accept the calculated loads and deflections.
      e. Detailed shop drawings stamped and signed by a registered professional engineer.
      f. Structural details and calculations stamped and signed by a registered professional structural engineer.

g. Expansion Joints to be designed and manufactured to the current Expansion Joint Manufacturers Association (EJMA) standards. Manufacturer of expansion joints to be certified by EJMA.

1.05 SUBMITTALS

A. Submit the following:
   1. Product Data
   2. Shop Drawings showing details of construction, dimensions, arrangement of components, and isolation.
   3. Structural Details and Calculations: Submit structural details and calculations substantiating that building structure, anchorages, and fabricated steel braces can safely withstand maximum calculated loads.
   4. Specified testing requirements.
   5. Operating and Maintenance Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joints and Compensators:
   1. Flexonics
   2. Keflex
   3. Hyspan
   4. Metraflex
   5. Other Manufacturers: Submit substitution request.

B. Expansion Loops/Seismic Expansion Joints:
   1. Metraflex Metraloop
   2. Other Manufacturers: Submit substitution request.

2.02 EXPANSION JOINTS AND COMPENSATORS

A. Expansion compensators to be of the packless, externally pressurized type to allow for axial movement constructed of stainless steel bellows, stainless steel shroud, integral guide rings, internal liner, limit stops, with drain port and plug.

B. All materials of construction and pressure ratings shall be appropriate for the application as specified for each piping material and service.

2.03 EXPANSION LOOPS/SEISMIC EXPANSION JOINTS

A. Flexible stainless steel hose and braid connector.

B. Connector shall accept differential support displacement without damaging pipe, equipment connections, or support connections.

C. All materials of construction and pressure ratings shall be appropriate for the application as specified for each piping material and service.

PART 3 EXECUTION

3.01 EXPANSION JOINTS AND COMPENSATORS

A. Install piping risers in wood structures to compensate for 1/2-inch of shrinkage per floor. Contractor is responsible to determine quantities and locations required.

B. Install in piping to compensate for thermal expansion and contraction. Responsible to determine quantities and locations required.

C. Install in other locations indicated on the drawings.

D. Provide and install pipe alignment guides as recommended by the expansion joint manufacturer with the first guide no more than 4 pipe diameters away from the expansion joint or compensator and second guide no more than 14 pipe diameters from first guide.

E. Install per manufacturer’s installation instructions.

3.02 EXPANSION LOOP / SEISMIC EXPANSION JOINT

A. Install at building seismic expansion joints.

B. Install in piping to compensate for thermal expansion and contraction. Contractor is responsible to determine quantities and locations required.

C. Install in other locations indicated on the drawings.

D. Install per manufacturer's installation instructions.

END OF SECTION

SECTION 23 0519

METERS AND GAUGES FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Thermometers - Water
   2. Pressure Gauges - General
   3. Differential Pressure Gauges
   4. Water Flow Meter

1.02 RELATED SECTION

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Submit the following:
   1. Products listed in this Section.
   2. Operating and Maintenance Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermometers - Water:
   1. Ashcroft
   2. Weiss
   3. Trerice
   4. Marsh
   5. Weksler
   6. Tel-Tru
   7. Other Manufacturers: Submit substitution request.

B. Pressure Gauges - General:
   1. Marsh
   2. Ashcroft
   3. Weiss
   4. Trerice
   5. Weksler
   6. Tel-Tru
   7. Other Manufacturers: Submit substitution request.

C. Differential Pressure Gauges:
   1. Between Rooms: Dwyer magnahelic Model 2000-00, 0-0.25 inches of water range.
   2. Across Filters: Dwyer magnahelic Model 2002-AF, 0-2.0 inches of water range with air filter gauge accessory package.

D. Water Flow Meter:
   1. Sparling.
   2. Other Manufacturers: Submit substitution request.

2.02 THERMOMETERS - WATER

A. Direct mounted 5-inch dial type, stainless steel case, separable sockets, stem length to penetrate minimum of 1/2 pipe diameter, adjustable face, extension necks where required to clear insulation, accuracy of 1 percent of range.

B. Range:

HVAC Systems	Temperature	Graduations
Dual Temperature Water	25-240 degrees F	1 degrees F

2.03 PRESSURE GAUGES - GENERAL

A. Description: 4-1/2-inch dial, molded black polypropylene turret case.

B. Range:

HVAC Systems	Pressure	Graduations
Dual Temperature Water	0-100 psi	1 psi

2.04 DIFFERENTIAL PRESSURE GAUGES

A. Description: Surface mounted diaphragm-actuated dial type with zero pointer adjustment. Provide 4-inch minimum dial diameter with black figures on a white background.

B. Tubing: Copper; polytube may be used if concealed inside walls.

2.05 WATER FLOW METER

A. Provide Vortex shedding flow meter that provides output signals, which are linear with the flow rate.

B. Accuracy +/-1 percent of measurement for volumetric flow rates greater than 5 percent of specified maximum flow rate for each building.

C. Flowmeter provides specified accuracy when installed and configured for upstream minimum straight runs of 24-inches.

D. Vortex flow meter shall be Intelligent microprocessor-based, with integral LCD digital Display/Configurator allowing complete commissioning and operation without external programming devices.

E. Meter design permits maintenance and repair of flow sensor and electronics without removing the meter from line or shutting down steam flow.

F. Flowmeter to have turn down ration of 50:1 or higher.

G. ANSI 150 flanged end connections, wafer style is not acceptable.

H. Flange size of the adjoining pipe of the same nominal size as the flow meter.

I. Mount flow meter in a straight, unobstructed pipe with a minimum of 10 pipe diameters upstream of the meter and 5 pipe diameters downstream, compensating for any induced flow effects according to manufacturer's recommendations.
   1. Maximum Operating Pressure: 400 psi
   2. Output Signal: Analog 4-20mA signal
   3. Supply Voltage: 24VDC
   4. Interrogation: FoxCom version
   5. Based on: FoxBoro I/A Series Intelligent Vortex Flow Meter 83

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Provide meters and gauges where shown on Drawings.

B. Install gauges and meters as required and as recommended by equipment manufacturer or their representative.

C. Extend connections, wells, cocks, or gauges to a minimum of 1-inch beyond insulation thickness of the various systems.

D. Locate gauges so that they may be conveniently read at eye level or easily viewed and read from the floor or from the most likely viewing area, i.e., platform, catwalk, etc.

E. Install instruments over 6-feet-6-inches above floor, to be viewed from the floor, with face at 30 degrees to horizontal.

3.02 INSTALLATION - PRESSURE GAUGES

A. Provide instrument gauge cock at inlets. Provide protective siphon on steam gauges.

B. Locate pressure gauge taps for measuring pressure drop or increase across pumps, coils, condensers, etc., as close to the device as possible.

3.03 WATER FLOW METER

A. Install in accordance with the manufacturer's recommendations, with sufficient upstream and downstream straight pipe to obtain accurate readings.

END OF SECTION

SECTION 23 0523

GENERAL DUTY VALVES AND SPECIALTIES FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Gate Valves
   2. Globe Valves
   3. Check Valves
   4. Ball Valves
   5. Butterfly Valves
   6. Balancing Valve
   7. Specialty Valves
   8. System Specialties
   9. Integrated Coil Piping Connector
   10. Diaphragm Expansion Tank System
   11. Air/Dirt Separator – High Efficiency Coalescing
   12. Pressure Reducing Valve (Closed Hydronic System Feed)
   13. Water Relief Valves
   14. Strainers
   15. Suction Diffusers

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Submit product data.

B. Submit balancing valve schedule with manufacturer, model, size, flow rate and pressure drop.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. General: Where only NIBCO figure numbers are listed, equivalent products by those specified below are acceptable.

B. Gate Valves:
   1. Apollo
   2. Victaulic
   3. Crane
   4. Kennedy
   5. Stockham
   6. Milwaukee
   7. Walworth
   8. Hammond

C. Globe Valves:
   1. Apollo
   2. Victaulic
   3. Crane
   4. Kennedy
   5. Stockham
   6. Milwaukee
   7. Walworth
   8. Hammond

D. Check Valves:
   1. Mueller
   2. Metraflex
   3. Victaulic
   4. Bell and Gossett
   5. Milwaukee
   6. Gruvlok.

E. Ball Valves:
   1. Gruvlok
   2. Apollo
   3. Crane
   4. Hammond
   5. Milwaukee
   6. Victaulic

F. Butterfly Valves:
   1. Apollo
   2. Victaulic
   3. Gruvlok
   4. Crane
   5. Walworth
   6. Milwaukee
   7. Metraflex

G. Balancing Valve:
   1. DeZurik
   2. Homestead
   3. Bell and Gossett
   4. Armstrong
   5. Walworth
   6. Taco
   7. Wheatley
   8. Tour & Andersson
   9. Victaulic
   10. Gruvlok
   11. NIBCO

H. Specialty Valves:
   1. Gauge Cocks:
      a. Conbraco
      b. Or approved equal.
   2. Drain Valves:
      a. Gruvlok
      b. Apollo
      c. Crane
      d. Hammond
      e. Milwaukee
      f. Victaulic
      g. Or approved equal.

I. System Specialties:
   1. Manual Air Vents:
      a. Coin type
      b. Dole 9
      c. Or approved equal.

2. Automatic Air Vents:
    a. Hoffman 78
    b. Amtrol
    c. Armstrong
    d. Spirax-Sarco Engineering
    e. Spirotherm Spirotop
    f. Or approved equal.
3. Pressure/Temperature Test Plug:
    a. Peterson Engineering, Inc.
    b. Universal Lancaster
    c. Sisco
    d. Trerice
    e. Or approved equal.

J. Integrated Coil Piping Connector:
1. Griswold Controls
2. HCi
3. Or approved equal.

K. Diaphragm Expansion Tank System:
1. Amtrol
2. Bell & Gossett
3. Armstrong
4. Wheatley
5. Taco
6. Or approved equal.

L. Air/Dirt Separator – High Efficiency Coalescing:
1. Spirotherm Spirovent VDT
2. Taco
3. Or approved equal.

M. Pressure Reducing Valve (Closed Hydronic System Feed):
1. Bell & Gossett
2. Armstrong
3. Taco
4. Amtrol
5. Cash Acme
6. Or approved equal.

N. Water Relief Valves:
1. Consolidated
2. Kunkle Valve
3. B&G, Armstrong
4. Cash Acme
5. Or approved equal.

O. Strainers:
1. General:
    a. NIBCO
    b. Armstrong
    c. McAlear Mfg. Co.
    d. Sarco, Inc.
    e. Steamflo
    f. Mueller
    g. R.P. & C. Company
    h. Titan Flow Control
    i. Or approved equal.

2. Grooved Coupling Systems:
    a. Gruvlok
    b. Victaulic

P. Suction Diffusers:
1. General:
    a. Bell & Gossett
    b. Armstrong
    c. Taco
    d. Amtrol
    e. Wheatley
    f. Paco
    g. Mueller
    h. Or approved equal.
2. Grooved Piping Systems:
    a. Gruvlok
    b. Victaulic

Q. Use one manufacturer on valves.

R. Threaded, flanged, soldered, or grooved valve ends, as applicable to piping system. Refer to Section 23 2113, Pipe and Pipe Fittings HVAC for allowable fittings.

2.02 GATE VALVES

A. Iron Gate, OS&Y: Iron body, bronze trim, OS&Y pattern, solid wedge, 150 psi rating; NIBCO 637.

B. Service: Main boiler shutoff valves.

2.03 GLOBE VALVES

A. Bronze Globe and Angle Globe: Bronze body, bronze mounted, renewable composition disc, 150 psi rating; NIBCO 235 or 335.

2.04 CHECK VALVES

A. Horizontal Bronze Swing Check: Bronze body, bronze mounted, regrinding bronze disc, 150 psi steam rating, 300 psi WOG; NIBCO 433-Y.

B. Horizontal Iron Swing Check: Iron body, bronze mounted, regrinding bronze disc and seat ring, 125 psi rating; NIBCO 918.

C. Vertical and Silent Check Valves:
1. 250 pounds WOG, iron body, stainless steel trim, globe type with flanged ends; NIBCO 960.
2. 300 psig CWP, ductile iron body, stainless steel spring, and shaft. Victaulic Series 716.
3. 230 psig CWP, AGS grooved end ductile iron body, stainless steel spring, shaft, and disc, EPDM seat. Victaulic Series W715.

D. Vertical and Silent Check Valves: 250-lb. WOG, iron body, stainless steel trim, wafer type; NIBCO W-960.

2.05 BALL VALVES

A. Bronze Ball: Bronze cast body or forged brass, chrome-plated full port ball, with handle, Teflon seat, 300 psi WOG, 150 psi steam; NIBCO 585-70 or Victaulic Series 589.

2.06 BUTTERFLY VALVES

A. Ductile iron body, electroless-nickel chrome plated disc and stainless steel shaft (shaft offset from the disc centerline to provide complete 360-degree circumferential seating), with lever handle and locking feature on valves 6-inches and less, gear operator on valves 8-inches and over; stem neck length to accommodate insulation where applicable, pressure responsive EPDM liner, 300 psi water; Victaulic MasterSeal, NIBCO 2000, NIBCO 4765.

2.07 BALANCING VALVE

A. Calibrated:
   1. Venturi style design. Valve to perform the following functions: Precision flow measurement, precision flow balancing, memory stops, positive shut-off to a minimum of 250 psi, drain port suitable for hose bibb fitting. Threaded or solder ends for 1/2-inch through 2-inches. 1/2-inch valve shall be capable of balance to 0.5 GPM. Grooved or flanged ends for 2-1/2-inches through 12-inches. Bell and Gossett, Flow Design, Griswold, Nutech, Pro Hydronic.
   2. Size balancing valves based on the published performance curve characteristics for the scheduled flow rate for each location to ensure proper operation at design conditions.

2.08 SPECIALTY VALVES

A. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch; Conbraco 41 series.

B. Drain Valves: Bronze globe valve or full port ball valve, garden hose end, cap, and chain 3/4-inch size.

2.09 SYSTEM SPECIALTIES

A. Automatic Air Vents: Water main type, cast brass body, built-in check valve, 1/8-inch I.P.S. top tapping for moisture discharge, 3/4-inch size, 150 psi operating pressure.

B. Temperature and Pressure Test Plugs:
   1. General: 1/2-inch N.P.T. fitting to receive either a temperature or pressure probe 1/8-inch O.D., fitted with a color coded and marked cap with gasket.
   2. Material: Solid brass with valve core of NORDEL.
   3. Rating: Minimum 300 psig at 275 degrees F.
   4. Gauges and Thermometers: Supply Owner with two pressure gauge adapters with 1/8-inch O.D. probe and two five-inch stem pocket test thermometers
      25 degrees - 125 degrees F for chilled water, 40 degrees -240 degrees F for heating water.

2.10 INTEGRATED COIL PIPING CONNECTOR

A. Full port forged brass isolation valves with integral union and pressure temperature port, strainer where indicated, flow meter, balance valve with memory stop, air vents, and drains.

B. Integrated flexible hose connector assembly not allowed.

C. Use the same manufacturer as approved assembly supplier listed in this section or other approved manufacturers listed for each component in other sections of this specification.

D. Meet the specifications for each component as listed on other sections of the specification.

E. Capable of continuous operation at 150 psi and system test pressure when installed in piping systems.

F. Assembly the same size as the pipe it connects and have pipe thread connectors on both ends with male or female end adapters as required, except the balancing valve may be a smaller size as required to balance the flow.

2.11 DIAPHRAGM EXPANSION TANK SYSTEM

A. Expansion Tank:
   1. Diaphragm type of welded steel, constructed and stamped in accordance with ASME Code for 125 psi working pressure.
   2. Support with steel legs or bases for vertical installation or steel saddles for horizontal installation.
   3. Precharge with compressed air to minimum fill pressures.

2.12 AIR/DIRT SEPARATOR – HIGH EFFICIENCY COALESCING

A. Turbulence suppressive type air eliminator to separate microbubbles and to remove stationary air pockets through absorption. Brass or steel body with centerlined inlet and outlet for in-line piping. Valved side tap to bleed large amounts of air during system fill.

B. Integrated brass venting mechanism on top. Blowdown connection port at bottom.

C. Maximum working pressure, 150 psi. Maximum working temperature 250 degrees F. Maximum allowable water velocity, 4ft/second. Maximum pressure drop 0.5-feet.

D. Air elimination efficiency of 100 percent free air, 100 percent entrained air, 99.6 percent dissolved air.

E. Dirt separation efficiency of 80 percent of particles 30 micron and larger with 100 passes.

2.13 PRESSURE REDUCING VALVE (CLOSED HYDRONIC SYSTEM FEED)

A. Description: Self-filling type with low inlet pressure check valve, removable strainer, adjustable range, and set point as indicated on the Drawings.

B. Construction:
   1. Iron body for steel piping installation, brass body for copper piping installation.
   2. Brass working parts.

C. Size: 3/4-inch unless shown otherwise.

2.14 WATER RELIEF VALVES

A. Bronze or steel body, stainless steel or bronze, pressure settings to 160 psi at 250 degrees F, conforming to Section IV of ASME Code, size per manufacturer's recommendations based on Code, setting as indicated; Kunkle Model 537.

2.15 STRAINERS

A. Wye Pattern:
   1. Bronze: Bronze body, 250 psi, 1/16-inch perforated type 304 stainless screen.
   2. Ductile Iron: Ductile iron body, 300 psi, 1/16 or 1/8-inch 304 stainless steel screen.
   3. Cast Iron: Cast iron body, 125 psi, 1/16-inch perforated type 304 stainless screen.
   4. Cast Iron, High Pressure: Cast iron body, 250 psi, 1/16-inch perforated type 304 stainless screen.

B. Basket Pattern:
   1. Semi-steel body, flanged connections, closed bottom basket.
   2. Maximum working pressure: 125 psi WOG
   3. Screen: 1/8-inch perforated type 304 stainless steel screen
   4. Cover: Clamped or bolted.

2.16 SUCTION DIFFUSERS

A. Description:
   1. Angle type body with inlet straightening vanes and combination orifice cylinder-diffuser-strainer with 3/16-inch diameter openings.
   2. Provide inlet vane length equal to 2-1/2 times pump connection diameter.
   3. Provide adjustable support foot to carry the weight of suction piping, drain plug, and pressure gauge tap.

B. Construction:
   1. Cast iron body rated for 175 psig operating pressure at 300 degrees F.
   2. Provide steel inlet vanes on closed systems, stainless steel on open systems and domestic water systems.
   3. Provide steel orifice cylinders on closed systems, stainless steel on open systems and domestic water systems.
   4. Provide bronze mesh start-up strainers on closed systems and domestic water systems, none on open systems.

C. Selection:
   1. Outlet Size: Match pump inlet size.
   2. Inlet Size:
      a. Match pipe size upstream.
      b. Maximum of 2 psi drop without start-up strainer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide valves at connections to equipment where shown or required for equipment isolation.

B. Install valves and strainers in accessible locations and same size as connected piping (not the size of the equipment connection), except balancing valves sized by contractor to properly balance the flow.

C. Provide separate support for valves where necessary.

D. Provide drain valves in low points in the piping system, at coils and equipment, and as indicated.

3.02 APPLIED LOCATIONS HVAC VALVES

A. Piping 2-inches and Smaller:

System	Valve Types				
	Gate	Globe	Swing Check	Ball	Butterfly
Heating Water and Dual Temperature Water	Not Allowed	Bronze	Bronze	Bronze	Not Allowed

B. Piping 2-1/2-inches and Larger:

System	Valve Types				
	Gate	Globe	Check	Ball	Butterfly
Chilled Water and Dual Temperature Water	Not Allowed	Not applicable	Iron, Swing	Not Allowed	Ductile Iron
Heating Water	Iron (Boiler iso only)	Not applicable	Iron, Swing	Not Allowed	Ductile Iron
Pump Discharge	Not Allowed	Not applicable	Iron, Silent Check: Globe or Water Style,	Not Allowed	Ductile Iron

C. Calibrated venturi balancing valves 2-1/2-inch and smaller, on water coils and in piping systems in accordance with manufacturer's recommendations.

D. Provide gauge cock for pressure gauges.

E. Provide gate valves with pressure type packing glands for heating water boiler shutoff applications. Meet requirements of ASME Boiler and Pressure Vessel Code, Section IV, Article 7 for Stop Valves.

3.03 VALVE IDENTIFICATION

A. General: Identify valves to indicate their function and system served.

B. See Section 23 0553, Identification for HVAC Piping and Equipment.

3.04 CHAIN OPERATORS

A. Install valves in equipment rooms or fan rooms used for equipment or coil isolation and more than 8 feet above floor with stem horizontal and equipped with chain wheels and chains extending to 6-feet above floor.

3.05 INSTALLATION

A. Manual Air Vents:
   1. Install at high points where automatic air vents are not used, where noted, and where required for proper venting of system.
   2. Install in accordance with manufacturer's recommendations.

B. Automatic Air Vents:
   1. Install automatic air vents at high points where air can collect in water systems where indicated. Route drain lines from vent to nearest floor drain.
   2. Install 3/4-inch globe shut-off valve ahead of air vent. Install ball valve where bucket drainage is required.

C. Grooved Mechanical Pipe Valve End Connections:
   1. Refer to Section 23 21 13, Pipe and Pipe Fittings HVAC for allowed service installations.
   2. Install in accordance with the manufacturer's published installation instructions.
   3. Mold and produce gaskets by the coupling manufacturer, and suitable for the intended service.
   4. The coupling manufacturer's factory trained representative:
      a. Provide on-site training for the contractor's field personnel in the use of grooving tools and installation of grooved joint products.
      b. Periodically visit the project site to ensure best practices in grooved installation are being followed.
      c. A distributor's representative is not considered qualified to conduct the training or field visits.

D. Test Plugs: Install where indicated and in accordance with the manufacturer's recommendations.

E. Coil Connectors:
   1. Applied Locations: Integrated coil connectors are prohibited except where specifically indicated below or on the drawings.
      a. Small Indoor Air Handling Units as specified in 23 7000, duct coils.
   2. Make connections in accordance with Section 23 2113, Pipe and Pipe Fittings HVAC.

F. Expansion Tanks:
   1. Support with steel rods and brackets from structure or from structural steel stand as required.
   2. Pipe valve drain to over floor drain.

G. Air Separator:
   1. Install as shown on Drawings and in accordance with the manufacturer's recommendations.
   2. Suspend from structure with steel rods or brackets or support from steel stand as required.
   3. Bleed system air at start-up according to manufacturer's recommendations.

H. Pressure Reducing Valves:
   1. Install where indicated and in accordance with manufacturer's recommendations with 3 valve bypass.

I. Water Relief Valves:
   1. Install where indicated, and in accordance with manufacturer's instructions.
   2. Pipe discharge to nearest floor drain using Schedule 40 steel pipe.

J. Strainer:
   1. Provide valved blow off for each strainer of same size as plugs with maximum size of 1-1/2 inches.
   2. Pipe blow off full size and terminate over floor drains except finned tube, reheat coils, fan coils, terminal units, and unit heaters.

3. Applied Locations HVAC:
    a. Cast iron wye, chilled, heating, and heat recovery water, low pressure steam, low pressure condensate.
    b. Bronze wye, in piping 2-inch and smaller, medium, and high-pressure steam and condensate.
    c. Cast iron, high pressure wye, in piping 2-1/2-inch and larger, medium, and high-pressure steam and condensate.
    d. Basket, in piping 2-1/2-inch and larger, condenser water inlet to pumps.

K. Suction Diffusers:
1. Install on inlets of pumps where indicated in accordance with manufacturer's recommendations.
2. Support suction diffuser and piping from same surface as pump base is supported unless shown otherwise. Adjust foot so that pump inlet does not carry piping weight.
3. Pipe pressure gauges to gauge port and blow down to drain with ball shut-off valve.
4. After operating pumps for seven days, clean strainer and remove start-up strainer.

END OF SECTION

SECTION 23 0529

HANGERS, SUPPORTS AND ANCHORS FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. The provisions of Division 23, Heating, Ventilation and Air Conditioning (HVAC) Section 23 0500, Common Work Results for HVAC, apply to work specified in this Section.

1.02 SUMMARY

A. This Section includes Design-Build work.

B. This Section includes:
   1. Supports
   2. Anchors
   3. Pipe Rollers
   4. Insulation Protection Shields
   5. Insulation Protection Saddles
   6. Building Attachments

1.03 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0548, Vibration and Seismic Controls for HVAC Piping and Equipment

D. Section 23 0700, Insulation for HVAC

E. Section 23 2113, Pipe and Pipe Fittings HVAC

1.04 QUALITY ASSURANCE

A. Provide pipe and equipment hangers and supports in accordance with the following:
   1. Design supports, anchorages, and seismic restraints for equipment, and supports and seismic restraints for conduit, piping, and ductwork when not shown on the Drawings.
   2. Hangers, supports and sway braces to be fabricated in accordance with ANSI B31.1 and MSS SP-58 and SP-89.
   3. Use components for intended design purpose only. Do not use for rigging or erection purposes.
   4. Seismic restraints and anchorages shall resist seismic forces as specified in the state and local code or by the authority having jurisdiction for the seismic zone in which the project is constructed.
   5. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
   6. Seismic Restraints:
      a. Shall not introduce stresses in the piping caused by thermal expansion or contraction.
      b. Shall not exceed forces or design limits of the piping per ASME B31.9.
      c. Provide in accordance with the latest edition of the SMACNA, Seismic Restraint Manual Guidelines for Mechanical Systems" for the Seismic Hazard Level corresponding to the seismic zone in which the project is constructed.
      d. Provide in accordance with the local applicable codes.
      e. Follow provisions described in Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.
   7. Piping Connections to Equipment:
      a. Shall not introduce twisting, torsion, or lateral forces or moments on the equipment.
      b. Shall be supported and isolated in a manner not to exceed the equipment's point of connection load limitations.

B. Engineered Support Systems: Provide design services for the following support systems:
   1. Supports and seismic restraints for suspended piping, ductwork, and equipment.
   2. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
   3. Equipment, ductwork, and piping support frame anchorage to supporting slab or structure.

1.05 SUBMITTALS

A. Submit the following:
   1. Shop Drawings of contractor fabricated support structures.
   2. Structural Details and Calculations:
      a. Submit structural details and calculations substantiating that building structure, anchorages, and fabricated steel braces can safely withstand maximum calculated loads.
      b. Details and calculations to bear the seal of a professional engineer registered in the state having jurisdiction.
   3. No other submittals required under this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Supports:
   1. Unistrut
   2. Superstrut
   3. Powerstrut
   4. Kinline
   5. B-Line Systems
   6. AnvilStrut

B. Pipe Hangers:
   1. Anvil
   2. Superstrut
   3. B-Line Systems
   4. Tolco
   5. ERICO
   6. Pipe Shields Inc.
   7. Rilco

C. Pipe Rollers
   1. Anvil
   2. Super Strut
   3. B-Line Systems
   4. Tolco
   5. ERICO

D. Insulation Protection Shields
   1. Anvil
   2. Super Strut
   3. B-Line Systems
   4. Tolco
   5. ERICO

E. Insulation Protection Saddles
   1. Anvil
   2. Super Strut
   3. B-Line Systems
   4. Tolco
   5. ERICO

F. Pipe Guides
   1. Anvil
   2. B-Line Systems
   3. Pipe Shields Inc.
   4. Rilco
   5. Hyspan

G. Pipe Anchors
   1. Anvil
   2. B-Line Systems
   3. Pipe Shields Inc.
   4. Rilco

H. Building Attachments
   1. Anvil
   2. Elcen
   3. Superstrut
   4. B-Line Systems
   5. Tolco
   6. ERICO

2.02 SUPPORTS

A. Fabricate support members from welded standard structural shapes, pipe, and plate to carry the necessary rollers, hangers, and accessories as required. Support piping less than 4-inch pipe size from or by prefabricated roll-formed channels with necessary accessories to adequately support piping system.

B. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.

C. Dissimilar Metal Protection: Hydra-Zorb cushions or Cush-a-strip.

D. Clamps: Super Strut Series 700 through 702 or AnvilStrut Series 1000 through 1200.

2.03 PIPE HANGERS

A. Uninsulated Horizontal Copper Piping:
   1. 2-inch and Smaller: Anvil CT-65, CT-69.
   2. Larger than 2-inch:
      a. Anvil 260 field or factory copper plated, plastic coated or other recognized industry methods.
      b. Electricians' tape is unacceptable.

B. Insulated Horizontal Copper Pipe with Hangers Inside of Insulation: Same as Uninsulated Horizontal Copper Pipe.

C. Insulated Horizontal Copper Pipe with Hangers Outside of Insulation:
   1. 2-inch and Smaller: Anvil 65, 104 or 260.
   2. Larger than 2-inch: Anvil 260.

D. Other Uninsulated Horizontal Pipe:
   1. 2-inch and Smaller: Anvil 65, 104 or 260.
   2. Larger than 2-inch: Anvil 260.

E. Other Insulated Horizontal Pipe with Hangers Inside of Insulation:
   1. 2-inch and Smaller: Anvil 65, 104, 260 or 300.
   2. Larger than 2-inch: Anvil 260.

F. Other Insulated Horizontal Pipe with Hangers Outside of Insulation:
   1. 2-inch and Smaller: Anvil 65, 104 or 260.
   2. Larger than 2-inch: Anvil 260.

G. Riser Clamps Copper Pipe:
   1. 4-inch and Smaller: Anvil CT-121, CT-261.
   2. Larger than 4-inch: Anvil 261.

H. Riser Clamps Other Piping: Anvil 261.

2.04 PIPE ROLLERS

A. Cast Iron roll and sockets, steel roll rod.
   1. Anvil 171, 175, 177, 178, 181, or 274 as required.
   2. Size for pipe plus insulation for insulated pipe.

2.05 INSULATION PROTECTION SHIELDS

A. Galvanized carbon steel.
   1. Anvil 167.

2.06 INSULATION PROTECTION SADDLES

A. Carbon steel.
   1. Anvil 160 series.
   2. Saddles for copper pipe: Factory copper plated.

2.07 PIPE GUIDES

A. Spider type alignment guide.
   1. Anvil 255, 256, 257 & 436
   2. Steel Piping:
      a. Carbon steel housing
      b. Carbon steel spider clamp
   3. Copper Piping:
      a. Carbon steel housing
      b. Factory copper plated steel spider clamp

2.08 PIPE ANCHORS

A. Uninsulated Pipe
   1. Pipe Shields Inc. C1000

B. Insulated Pipe
   1. Pipe Shields Inc. C3000 through C4300 series

C. Pipe Stanchions
   1. Anvil 62

2.09 BUILDING ATTACHMENTS

A. Beam Hangers:
   1. On piping 6-inch and smaller: Anvil 86 with retaining clip Fig. 89.
   2. On piping larger than 6-inch: Anvil 228, or 292.

B. Inserts:
   1. Anvil 152 malleable iron or 281 steel inserts.
   2. Inserts sized for required rod to support load being carried.

C. Expansion Plugs: Similar and equal to Phillips “red-head” self-drilling flush shell selected for safety factor of 4.

D. Powder actuated fasteners with silencers as approved by Architect.

E. For kitchen applications provide NFPA 96 compliant curb with louvered openings to allow hot air and gases to escape between ductwork and roof curb.

PART 3 EXECUTION

3.01 HANGERS AND SUPPORTS

A. General:
   1. Install support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required, and as detailed on the Drawings.
   2. Provide adjustable hangers for pipes complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., except where specified otherwise.
   3. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping and do not support piping from other piping.
   4. Except as otherwise indicated for exposed continuous pipe runs, install hangers, and supports of same type and style as installed for adjacent similar piping.
   5. Support piping within 2-feet of each change of direction on both sides of fitting.

B. Insulated Piping Systems:
   1. Refer to Section 23 07 00, Insulation for HVAC for insulation requirements.
   2. Insulated Piping Systems with Vapor Barrier Insulation:
      a. Install hangers outside of insulation.
      b. On piping 1-1/2-inch and larger, provide insulation protection shields at each support location.
   3. Other insulated Piping Systems with Non-Vapor Barrier Insulation:
      a. At the contractor's option, hangers may be installed inside or outside of insulation for piping 2-inch and smaller.
      b. If hangers are installed outside of insulation, provide insulation protection shields at support locations on piping 1-1/2-inch and larger.
      c. On piping larger than 2-inch, provide insulation saddles at each support location.
   4. Insulation Protection:
      a. Band insulation protection shields firmly to insulation to prevent slippage.
      b. Tack weld insulation protection saddles to steel pipe. Braze saddles to copper pipe.

C. Vertical Piping:
   1. Support Spacing: Provide support at minimum spacing in accordance with state and local codes.
   2. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
   3. Provide mid-story vertical guide support where floor to floor distances exceed spacing as required by state and local codes. Riser clamps on steel pipe to be directly welded to pipe. Riser clamps on copper pipe to be installed directly under fitting.
   4. Risers that are not subject to thermal change to be supported at each floor of penetration.
   5. Risers that are subject to thermal change require engineered supports. Size supports to carry forces exerted by piping system when in operation. Riser supports follow the provisions described in Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Horizontal Piping:
   1. Trapeze Hangers:
      a. Multiple pipe runs where indicated supported on channels with rust resistant finish.
      b. Provide necessary rods and supporting steel.
   2. Support Spacing:
      a. Provide support at maximum spacing in accordance with state and local codes and any applicable manufacturer requirements.
      b. Support piping within 2-feet of each change in direction.

c. Provide piping with acoustical lagging wrap supported a maximum of 5-feet on center. Install hangers outside of acoustical lagging.

E. Building Attachments:
1. Fastening or attaching to steel deck (without concrete fill) is prohibited. It will be necessary to support piping from structural members, beams, joists, or provide intermediate angle iron supporting members between joists. Supports may be attached to concrete filled steel deck with load limitations shown on the structural drawings or otherwise obtained from the structural engineer.
2. Provide horizontal bracing on horizontal runs 1-1/2-inch and larger and exceeding 50-feet in length at 75-foot intervals and as required to provide stabilized piping systems.
3. Provide additional structural steel angles, channels, or other members required to support piping where structures do not occur as required for proper support.
4. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points.

END OF SECTION

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. The provisions of Division 23, Heating, Ventilation and Air Conditioning (HVAC) Section 23 0500, Common Work Results for HVAC, apply to work specified in this Section.

1.02 SUMMARY

A. This Section includes:
   1. Neoprene Waffle Pad
   2. Restrained Neoprene Mount
   3. Inertia Base
   4. Isolating Neoprene Hangers
   5. Isolating Sleeves
   6. Seismic Restraints

B. Isolation of mechanical equipment as indicated on the Drawings and specified herein.

C. Seismic restraint of equipment, piping, and ductwork.

1.03 RELATED SECTIONS:

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0518, HVAC Expansion Compensation

D. Section 23 0529, Hangers, Supports and Anchors for HVAC

E. Section 23 3101, HVAC Ducts and Casing-Low Pressure

F. Section 23 3102, HVAC Ducts and Casing-Medium Pressure

1.04 QUALITY ASSURANCE

A. Single manufacturer select and furnish isolation required, except packaged equipment with integral isolators meeting all the isolation and seismic requirements of this Specification.

B. System of vibration isolators and seismic controls designed, detailed, and bear the seal of a professional engineer registered in the State having jurisdiction.

C. Isolation performance requirements are indicated in the specifications. Deflections indicated are nominal static deflections for specific equipment supported.

D. Seismic snubbers, restrained isolator housings, and cable system components have anchorage preapproval OPM number from OSHPD in the State of California verifying the maximum certified load ratings.

E. Isolator Stability and Rated Capacity:
   1. Spring diameters not less than 0.8 of the compressed height of the spring at rated load.
   2. Springs have a minimum additional travel to solid equal to 50 percent of the rated deflection.

F. Seismic Restraints:
   1. Restraint of equipment, piping, and ductwork to be in accordance with the current state and local Building Code.
   2. Calculations in accordance with current state and local Building Code.

1.05 SUBMITTALS

A. Submit the following:
   1. Submit Shop Drawings showing complete details of construction for steel and concrete bases including:
      a. Equipment mounting holes.
      b. Dimensions
      c. Isolation selected for each support point.
      d. Details of mounting brackets for isolator.
      e. Weight distribution for each isolator.
      f. Code number assigned to each isolator.
   2. Submit product data and calculation sheets for isolators, showing:
      a. Size, type, load rating, and rated deflection of each required isolator.
      b. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.
   3. Structural Details and Calculations substantiating that building structure, anchorages, and fabricated steel braces can safely withstand maximum calculated loads stamped and signed by a registered structural engineer.
   4. Installation report as specified in PART 3 of this Section.
   5. Operation and maintenance data.

1.06 EQUIPMENT VIBRATION ISOLATION

A. Provide a balanced set of vibration isolators for each piece of equipment listed in the Equipment Schedules.

B. Isolation work to include, but not necessarily be limited to, the following:
   1. Isolation support of motor-driven equipment.
   2. Inertia base frames in conjunction with isolation.
   3. Isolation support of air-handling housings.
   4. Isolation support of piping, piping risers, and ductwork.
   5. Penetration isolation of pipework, ductwork, and conduits through walls, floors, or ceilings.
   6. Flexible connections of ductwork and piping to equipment.

C. Each piece of rotating equipment must meet a reasonable criterion for maximum vibration levels at each bearing, while in operation. The criteria for varying operating speeds are given as follows:
   1. Rotating equipment operating at peak vibration velocities must not exceed 0.08-inch/second.
   2. If it is discovered that the operating vibration velocities exceed this criteria, the equipment repaired or replaced at no expense to the owner until approval of the equipment is given by the Engineer.

D. Provide components or materials not specially mentioned herein, but necessary to the proper vibration isolation of the equipment.

1.07 CONTRACTOR RESPONSIBILITY

A. Vibration isolation devices, including auxiliary steel bases and pouring forms, design and furnish by a single manufacturer or supplier.

B. Adequately restrain all equipment, piping, and ductwork to resist seismic forces. Design and select restraint devices to meet seismic requirements as defined in the latest issue of the International Building Code under Earthquake Loads and applicable state and local codes.

C. Have the following responsibilities:
   1. Selection, installation, adjustment, and performance of vibration isolators which will meet the requirements given on the plans or in the Specifications.
   2. Provide Engineering drawings, details, supervision, and instruction to assure proper installation and performance.

3. Provide whatever assistance necessary to ensure correct installation and adjustment of the isolators.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Type 1 – Neoprene Waffle Pad:
   1. Mason Type Super W or Super WM and HG Grommet
   2. Kinetics Noise Control

B. Type 2 – Restrained Neoprene Mount:
   1. Mason Type BR
   2. Kinetics Noise Control

C. Type 6 – Inertia Base:
   1. Mason BMK or KSL
   2. Kinetics Noise Control
   3. Vibrex

D. Type 8 – Isolating Neoprene Hangers:
   1. Mason HD
   2. Kinetics Noise Control
   3. Vibrex

E. Isolating Sleeves:
   1. Potter-Roemer PR isolators
   2. Grinnell Semco Trisolators

2.02 TYPE 1 - NEOPRENE WAFFLE PAD

A. 3/4-inch thick neoprene waffle pads with pattern repeating on 1/2-inch centers.

B. Select Duro rating for recommended deflection at average load rating.

C. Include load distribution steel plate as required.

D. Include anchor bolt grommet as required.

2.03 TYPE 2 - RESTRAINED NEOPRENE MOUNT

A. Bridge-bearing neoprene mountings directional seismic capability.

B. Provide minimum deflection of 0.2-inch.

C. Ductile iron casting containing two separated and opposing molded neoprene elements.

D. Elements prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation.

E. Shock absorbing neoprene materials compounded to bridge-bearing specifications.

2.04 TYPE 6 – INERTIA BASE

A. Steel Inertia Base with 1/2-inch square bar reinforcing, for field grout.

B. Provide minimum clearance of 1-inch.

C. Bases must be sized to fit stanchions for pump elbows or suction diffusers.

D. Depth of base equal to 8 percent of the span between supports, 6-inch minimum.

E. Provide integral height saving brackets and steel templates with anchor bolts sleeves.

2.05 TYPE 8 – ISOLATING NEOPRENE HANGERS

A. Double deflection neoprene hangers.

B. Provide minimum static deflection of 0.35-inch.

C. Provide projecting bushing to prevent steel to steel contact.

2.06 ISOLATING SLEEVES

A. Provide for piping through walls and floors of penthouses and chiller room. Size for piping as required.

2.07 SEISMIC RESTRAINTS

A. General Requirements:
   1. Provided for equipment, piping and ductwork, both supported and suspended.
   2. Bracing of piping shall be in accordance with state and local code requirements and ASCE 7 Seismic Design Requirements for Nonstructural Components, whichever is most stringent.
   3. Bracing of ductwork shall be in accordance with the state and local code requirements, ASCE 7 Seismic Design Requirements for Nonstructural Components, and with the provisions set forth in the SMACNA seismic restraint manual.
   4. The structural requirements for the restraints, including their attachment to the building structure, shall be reviewed and approved by the Structural Engineer.
   5. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.

B. Supported Equipment:
   1. All-directional Seismic Rubbers: Interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene.
   2. Replaceable bushing and minimum of 1/4-inch thick. Rated loadings not to exceed 1000 psi.
   3. An air gap of 1/4-inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces.
   4. Snubber End Caps:
      a. Removable to allow inspection of internal clearances.
      b. Rotated neoprene bushings be rotated to ensure no short circuits exist before systems are activated.
   5. Snubber: Mason Industries, Inc. Type Z-1225

C. Bracing of Pipes:
   1. Provide seismic bracing of piping as detailed below to meet the building code requirements:
      a. Exception: Piping suspended by individual hangers need not be braced where the following criteria are met.
         1) Distance between the top of the pipe to the bottom of the support structure is 12-inches or less.
         2) Seismic braces are not required on high deformability piping when the Ip=1.0 and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 3-inch diameter or less.
         3) Seismic braces are not required on high deformability piping when the Ip=1.5 and provisions are made to avoid impact with larger pipe or mechanical components or to protect the pipe in the event of such impact and the nominal pipe size is 1-inch diameter or less.
   2. Seismic braces for pipes on trapeze hangers may be used.
   3. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints, or where pipes connect to equipment.
   4. Cast iron pipe of all types, glass pipe, and any other pipe joined with a shield and clamp assembly, where the top of the pipe is 12-inches or more from the supporting structure, shall be braced on each side of a change in direction of 90 degrees or more. Riser joints on unsupported sections of piping shall be braced or stabilized between floors.

5. Vertical risers shall be laterally supported with a riser clamp at each floor. For buildings greater than six stories high or for piping subject to thermal change all risers shall be engineered individually.

D. Bracing of Ductwork:
   1. Brace rectangular ducts with cross sectional areas of 6 square feet and larger. Brace flat oval ducts in the same manner as rectangular ducts. Brace round ducts with diameters of 28-inches and larger. Brace flat oval ducts the same as rectangular ducts of the same nominal size.
   2. Exception: No bracing is required if the duct is suspended by hangers 12-inches or less in length, as measured from the top of the duct to the bottom of the support where the hanger is attached.
   3. Transverse bracing shall occur at the interval specified in the SMACNA tables or at both ends if the duct run is less than the specified interval. Transverse bracing shall be installed at each duct turn and at each end of a duct run, with a minimum of one brace at each end.
   4. Longitudinal bracing shall occur at the interval specified in the SMACNA tables with at least one brace per duct run. Transverse bracing for one duct section may also act as longitudinal bracing for a duct section connected perpendicular to it if the bracing is installed within four feet of the intersection of the ducts and if the bracing is sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
   5. Install duct flex connections at equipment connections to accept expected differential displacement and protect the equipment connection from damage.

E. Suspended Equipment and Piping and Ductwork:
   1. Seismic cable restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.
   2. Cable must be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.
   3. Cable assemblies shall be type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod and the clevis or SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.
   4. Steel angles or strut, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall be type SRC or UCC as manufactured by Mason Industries, Inc.
   5. Pipe clevis cross-bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.

PART 3 EXECUTION

3.01 GENERAL

A. Do not install any equipment or pipe which makes rigid contact with the building.

B. The installation or use of vibration isolators must not cause any change of position of equipment or piping which would result in stresses in piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.

C. Correct, at no additional cost, all installations which are defective in workmanship or materials.

3.02 PREPARATION

A. Treat all isolators, including springs, hardware, and housing, with a corrosion protective coating of epoxy powder or electro galvanizing.

B. Coat steel frames exposed to weather with a rustproof metal primer.

C. Provide hot dipped galvanizing on steel frames as indicated on the plans for corrosion protection in severe conditions.

3.03 INSTALLATION

A. General:
   1. Install isolation where indicated on the Drawings by type and location and where indicated below.
   2. The assigned code number shall be marked on the isolators and bases to assure placement in the proper location.
   3. Anchor isolator seismic housing baseplate to floor.
   4. Rubber grommets and washers shall be provided to isolate the bolt from the building structure. Under no circumstances shall the isolation efficiency be destroyed when bolting the isolators to the building structure.

B. Type 1 – Neoprene Waffle Pad:
   1. Service:
      a. Small Floor Mounted Indoor Air Handling Units
      b. Condensing Units

C. Type 2 – Restrained Neoprene Mount:
   1. Service:
      a. Inline Centrifugal Fans
      b. Floor Mounted Inline Centrifugal Fans

D. Type 6 – Inertia Base with Springs:
   1. Service:
      a. Centrifugal Pumps:
         1) Fill with concrete to provide base weight equal to 2 times supported weight, including equipment, piping, and fluid.
         2) Support heels of pump suction and discharge elbows from base.
         3) Secure pump and heel supports with inserts and grout.

E. Type 8 – Isolating Neoprene Hanger:
   1. Service:
      a. Split-System Air Conditioning Units
      b. Inline Centrifugal Fans

F. Flexible Connectors:
   1. Mechanical Couplings: Provide three or more flexible couplings as vibration isolation as indicated on the drawings.

3.04 SEISMIC RESTRAINTS

A. General:
   1. Install and adjust seismic restraints so that the equipment, piping, and ductwork support is not degraded by the restraints.
   2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

B. Supported Equipment:
   1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.

2. Care must be taken so that the 1/4-inch air gap in the seismic restraint snubber is preserved on all sides in order that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.

C. Bracing of Pipes:
   1. Branch lines may not be used to brace main lines.
   2. Transverse bracing shall be at 40-feet maximum, except where a lesser spacing is indicated in the SMACNA Seismic Restraint Manual for bracing of pipes.
   3. Longitudinal bracing shall be at 80-feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity to resist both the seismic load and the additional force induced by expansion and contraction.
   4. Fuel oil, gas, cast iron pipe of all types, glass pipe and any other pipes joined with four band shield and clamp assembly shall be braced at 1/2 the spacings shown above.
   5. A rigid piping system shall not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.
   6. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24-inches of the elbow or tee.
   7. Branch lines may not be used to restrain main lines.
   8. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
   9. Subject to confirmation by field inspection, seismic bracing is not required on piping when the piping is supported by rod hangers and the hangers in the entire run are 12-inches or less in length from the top of the pipe to the supporting structure, hangers are detailed to avoid bending of the hangers and their attachments and provisions are made for piping to accommodate expected deflections.

D. Bracing of Ductwork:
   1. Transverse restraints shall occur at 30-foot intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
   2. Longitudinal restraints shall occur at 60-foot intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4-feet of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
   3. Hanger straps must be positively attached to the duct within 2-inches of the top of the duct with a minimum of two number 10 sheet metal screws.
   4. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
   5. Walls, including gypsum board nonbearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide solid blocking around duct penetrations at stud wall construction.
   6. Unbraced ducts shall be installed with a 6-inch minimum clearance to vertical ceiling hanger wires.

E. Suspended Equipment, Piping, and Ductwork Cable Method:
   1. The cables shall be adjusted to a degree of slackness approved by the Structural Engineer.

2. The uplift and downward restraint nuts and Mason type RW neoprene covered steel rebound washers for the Type 6 hangers adjusted so there is a maximum 1/4-inch clearance.
3. C-clamps for attachment to the bottom of I-beams must incorporate a restraining strap.

3.05 FIELD QUALITY CONTROL

A. Installation Report: Isolation manufacturer's representative shall confirm that all isolation is installed correctly and submit report stating that isolators are installed as shown on Shop Drawings, isolators are free to work properly, and that installed deflections are as scheduled and as specified.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Valve Identification
   2. Piping Markers
   3. Equipment Identification
   4. Concealed Equipment Identification
   5. Seismic Certification Label Requirements

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Submit the following:
   1. Valve Tag Directory: Submit for approval prior to fabrication of valve tags.
   2. Equipment Nameplate Directory: Submit for approval prior to fabrication.
   3. Operating and Maintenance Data: Include a copy of valve tag and equipment nameplate directories in each set of Operating and Maintenance manuals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Piping Markers:
   1. W.H. Brady
   2. Seton
   3. Marking Systems, Inc. (MSI)
   4. Other Manufacturers: Submit substitution request.

B. Concealed Equipment Identification:
   1. W.H. Brady
   2. Seton
   3. Other Manufacturers: Submit substitution request.

2.02 VALVE IDENTIFICATION

A. Valve Tags:
   1. General: Identify valves with metal tags, legends to be stamped or embossed. Indicate the function of the valve and its normal operating position; i.e.,

56 HW	(NUMBER AND CONTENT OF PIPE)
ISOLATION	(VALVE FUNCTION)
NO	(NORMAL OPERATION POSITION)

   2. Size: Valve tags 2-inch diameter with 1/4-inch high letters.
   3. Material: Use 0.04-inch brass tags.
   4. Automatic Valves and Regulating Valves:
      a. Use 1/16-inch thick laminated 3-ply plastic, center ply white, outer ply red, lamicoid, or equal.
      b. Form letters by exposing center ply.

B. Valve Tag Directory:
   1. Tag Number
   2. Location
   3. Exposed or Concealed
   4. Service
   5. Valve Size

6. Valve Manufacturer
7. Valve Model Number
8. Normal Operating Position of Valve

2.03 PIPING MARKERS

A. Label pipes with all-vinyl, semi-rigid plastic or strap-on labels.

B. For pipes O.D. smaller than 3/4-inch and for valve and fitting identification, use valve tag.

C. For sizes from 3/4 to 1-1/4-inch outside diameter, 1/2-inch letters, 8-inch marker width.

D. For sizes from 1-1/2 to 2-inch outside diameter, 3/4-inch letters, 8-inch marker width.

E. For sizes from 2-1/2 to 6-inch outside diameter, 1-1/4-inch letters, 12-inch marker width.

F. For sizes from 8 to 10-inch outside diameter, 2-1/2-inch letters, 24-inch marker width.

G. For sizes 10-inch outside diameter and larger, 3-1/2-inch letters, 32-inch marker width.

H. Identify pipe markers and color coded as follows with directional arrows.

HVAC SERVICE	PIPE MARKER *	BACKGROUND/TEXT COLOR
CHILLED WATER	CHILLED WATER SUPPLY	GREEN/WHITE
	CHILLED WATER RETURN	GREEN/WHITE
HEATING WATER	HEATING WATER SUPPLY	GREEN/WHITE
	HEATING WATER RETURN	GREEN/WHITE
DUAL TEMPERATURE WATER	DUAL TEMPERATURE WATER SUPPLY	GREEN/WHITE
	DUAL TEMPERATURE RETURN	GREEN/WHITE
* Directional arrow applied adjacent to pipe marker indicating direction of flow.		

2.04 EQUIPMENT IDENTIFICATION

A. Nameplates:
1. Tag pumps, air handling supply units, fans, terminal units, converters, and miscellaneous mechanical equipment items with engraved nameplates.
2. 1/16-inch thick, 3-inch by 5-inch laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
3. Identify unit with equipment tag as shown on Drawings and area served.
4. Permanently identify access points to fire dampers, smoke dampers, and combination fire and smoke dampers on the exterior of the duct by a label with letters 1/2-inch in height reading the following:
   a. Fire Damper
   b. Smoke Damper
   c. Fire/Smoke Damper
5. Label constructed from same material as equipment nameplates.

B. Equipment Nameplate Directory:
1. Include Owner and Contractor furnished equipment.
   a. Pumps
   b. Air Handlers
   c. Terminal Units
   d. Other Equipment Nameplates
2. List the following on the Nameplate Directory for each piece of equipment:
   a. Designation
   b. Model Number
   c. Location of Equipment
   d. Area Served or Function
   e. Disconnect Location
   f. Normal Position of HOA Switch

2.05 CONCEALED EQUIPMENT IDENTIFICATION

A. Adhesive Laminated Tape:
   1. 3/4 width transparent clear tape with black lettering.
   2. Lettering in all caps Helvetica font 24 point.

PART 3 EXECUTION

3.01 VALVE IDENTIFICATION

A. Valve Tags:
   1. Attach to valve with a brass chain.
   2. Valve tag numbers continuous throughout the building for each system.

B. Valve Tag Directory: Post final copy in Operation and Maintenance Manual.

3.02 PIPING MARKERS

A. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
   1. Every 20-feet along continuous exposed lines.
   2. Every 10-feet along continuous concealed lines.
   3. Adjacent to each valve, flange, and stub-out for future.
   4. On pipe before and after wall, floor, and ceiling penetrations.
   5. On pipe into and out of concealed spaces.
   6. Adjacent to changes in pipe direction.
   7. On each riser.
   8. Adjacent to each leg of a T.
   9. Locate conspicuously where visible. Position pipe labels on pipe to achieve the best visibility.
   10. Apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above.

B. Apply arrow labels indicating direction of flow.

3.03 EQUIPMENT IDENTIFICATION

A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.

B. Nameplate Directory: Post final copy in Operation and Maintenance Manual.

3.04 CONCEALED EQUIPMENT IDENTIFICATION

A. Where valves or equipment are located above ceilings or behind walls provide adhesive tape indicating the item (valve tag, equipment tag, etc.) at the access location (T-bar ceiling grid, access door, etc.).

B. Applicable equipment includes, but is not limited to, the following:
   1. Terminal Units
   2. Fan Coil Units
   3. Fans
   4. Isolation Valves
   5. Control Valves

END OF SECTION

SECTION 23 0590

PRESSURE TESTING FOR HVAC SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Pressure Testing of Piping and Ductwork Systems

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 QUALITY ASSURANCE

A. Code Compliance: Perform required tests in the presence of the authority having jurisdiction.

B. Owner Witness: Perform tests in the presence of the Owner's representative.

C. Engineer Witness: The Engineer or Engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.

D. Simultaneous Testing: Test observations by the authority having jurisdiction, the Owner's representative, and the Engineer's representative need not occur simultaneously.

1.04 SUBMITTALS

A. Submit the following:
   1. Test Reports:
      a. Submit certificate of completion, inspection and test by authority having jurisdiction on required piping systems.
      b. Submit certificate of test approval by Owner's representative on all systems.
      c. For ductwork testing, submit the Test Report.
      d. Test report shall contain description of the testing procedure and results, including recommendation for any remedial actions needed.
      e. The Engineer's representative will record witnessed tests.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION

3.01 GENERAL

A. Piping:
   1. Test prior to concealment, insulation being applied, and connection to equipment, fixtures, or specialties.
   2. Conduct tests with all valves but those used to isolate the test section 10 percent closed.

B. Ductwork: Test prior to connection to equipment and before applying insulation.

C. Leaks: Repair all leaks and retest until stipulated results are achieved.

D. Notification:
   1. Advise the Construction Manager 72 hours in advance of each test.
   2. Failure to so notify will require test to be rescheduled.

E. Testing Equipment: Provide all necessary pumps, gauges, connections, and similar items required to perform the tests.

3.02 TESTING REQUIREMENTS

A. Low Pressure Ductwork:
   1. Test all ductwork systems at the static pressure that the duct will be classified at, using a Pacific Air Products Port-O-Lab or Rolok, or a McGill Airflow leak detective testing machine or approved equivalent.
   2. All ductwork testing shall be conducted in accordance with latest published version of the SMACNA HVAC Air Duct Leakage Test Manual.

3. Prior to testing verify that all low-pressure ductwork has been sealed to meet the SMACNA Seal Class C. for all joints.
4. Low pressure ductwork leakage shall be less than or meet the requirement of the following SMACNA Leakage Classes:
   a. Rectangular Metal – Class 24
   b. Round or Flat Oval – Class 12
5. Maximum allowable leakage is defined as CFM air leakage per 100 SF surface area of duct section tested.
6. All low pressure ductworks shall be tested.

B. Piping - General:
1. Test all piping as noted below, with no leaks or loss in pressure/vacuum for time indicated.
2. Repair or replace defective piping until tests are completed successfully:

HVAC Systems	Test Pressure	Test Medium	Test Duration
Heating/Chilled Water	150 psig	Water	4 hours
Refrigerant piping	450 psig**	Nitrogen	24 hours

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Testing and Balancing of Air Systems
   2. Testing and Balancing of Hydronic Systems
   3. Testing and Balancing of Miscellaneous Mechanical Equipment

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0800, Commissioning for HVAC

D. Section 23 0900, Instrumentation and Controls for HVAC

1.03 QUALITY ASSURANCE

A. Acceptable Testing and Balancing Firms:
   1. A.I.R., Inc.
   2. Air Balance Specialty, Inc.
   3. Neudorfer Engineers, Inc.
   4. Northwest Engineering Services
   5. American Commissioning Consultants
   6. Accurate Balancing Agency, Inc.

B. Other Firms: Submit substitution requests prior to bid date.

C. Industrial Standards: Testing and Balancing shall conform to NEBB, American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), and American National Standards Institute (ANSI) as follows:
   1. NEBB: Comply with Procedural Standards for Testing, Adjusting Balancing of Environmental Systems.
   2. ASHRAE: Comply with recommendations pertaining to measurements, instruments, and testing, adjusting and balancing.
   3. ANSI:
      a. S1.4 Specifications for sound level meters.
      b. S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.

D. Instrument Certification: Instruments used shall be accurately calibrated and certified within six months of balancing and maintained in good working order.

E. Test Observation: If requested, the tests shall be conducted in the presence of the Architect or the Architect's representative.

1.04 SUBMITTALS

A. Submit the following:
   1. Balancing Log:
      a. Include all air and water outlets, actual field measured air and water volume, and percentage of design volumes.
      b. Provide drawings identifying location of all outlets.
   2. Equipment Data Sheets: Indicate actual equipment performance, model numbers, bearing and belt data, motor nameplate data, and final balanced motor data.
   3. Additional Data: Submit additional data as provided by Associated Air Balance Council (AABC) Standard forms.
   4. Number of Copies: Submit six copies of the above completed information to the Engineer for review and insertion into the Operating and Maintenance Data.

5. Instrument Certification: When requested, submit certificate of calibration for equipment to be used.

B. Record data on NEBB forms or forms approved by the Architect.

1.05 PROJECT CONDITIONS

A. Do not perform final testing, adjusting, and balancing work until heating, ventilating, and air conditioning equipment has been completely installed and operating continuously as required.

B. Conduct air testing and balancing with clean filters in place. Clean strainers, etc., prior to performing hydronic testing and balancing.

1.06 WARRANTIES

A. In addition to the Requirements of the Contract, include an extended warranty of six months after completion of test and balance work during which time the Architect at his discretion may request a recheck or resetting of any equipment or device listed in the test reports.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Balance to maximum measured flow. Deviation from specified values of ±10 percent at terminal device and ±5 percent at equipment, or mean sound level deviation of 15 decibels. Advise Engineer if deficiencies are generally noted to enable proper corrective actions.

3.02 AIR SYSTEMS

A. General: Make measurements in accord with Industrial Standards specified above. Record on appropriate forms.

B. Preliminary:
1. Identify and list size, type, and manufacture of all equipment to be tested including air outlets and inlets.
2. Use manufacturer's ratings for equipment to make required calculations except where field test shows ratings to be impractical.

C. Central System:
1. Set speed to provide air volume at farthest run without excess static pressure. Provide additional sheaves and belts as required to accomplish speed adjustment.
2. Read and adjust air supply, return, and exhaust fan units to deliver design conditions at minimum OSA and at 100 percent OSA.
3. Adjust automatic dampers, outside air, return air, and exhaust dampers for design conditions.
4. Read static air pressure conditions on all air handling equipment including filter and coil pressure drops and total pressure across the fan. A Dwyer Series 400 air velocity meter only shall be used for final static pressures at equipment and where critical readings are required.
5. Measure temperature conditions across all outside air, return air, and exhaust dampers to check leakage.
6. Read and record motor data and amperage draw.
7. For variable volume systems, establish minimum static pressure required at sensing point to permit operation over entire VAV range. Adjust supply and return fan speed so that at maximum demand the associated VFD is controlling the motor of motor nameplate RPM to 100 percent. Adjust return fan speed so that return air volumes track with supply air volume minus exhaust air volume.
8. Assist controls contractor in establishing minimum outside air damper positions.

D. Distribution:
1. Evaluate all building and room pressure conditions to determine adequate supply and return air conditions. Balance the building to be slightly positive to outdoors.

2. Evaluate all building and room pressure conditions to determine adequate performance of the system to maintain temperatures without draft.
3. Perform multipoint pitot traverses to confirm instrumentation, shaft tightness, fan operation, etc. Pitot traverses shall be performed using a Dwyer Series 400 air velocity meter only with applicable duct probe.
4. Mark balancing dampers.

3.03 HYDRONIC SYSTEMS

A. General: Make measurements in accord with Industrial Standards specified above. Record on appropriate forms.

B. Preliminary:
1. List complete data of tested equipment and verify against Contract Documents.
2. Open all line valves to full open position, close coil by-pass stop valves, and then set mixing control valve to full coil flow.
3. For each pump:
   a. Verify rotation.
   b. Test and record pump shut-off head.
   c. Test and record pump wide-open head.
4. Verify proper system pressures.
5. Verify air vents in high points of water are properly installed and operating freely.

C. Central Equipment:
1. Check all conditions at all coils for required performance at design conditions.
2. Check conditions at all primary source equipment for performance of design conditions.
3. Read and record pump heads, motor data, and amperage draw.

D. Distribution:
1. Read and adjust water flow for design conditions.
2. Set all memory stops and mark position of adjuster on balancing valves.

3.04 ELECTRIC HEATING EQUIPMENT

A. Test and record voltage and amperage readings at each electric heating device while fully energized and at part load conditions (each step) to verify proper operation.

B. Record data on appropriate forms.

3.05 AUTOMATIC CONTROL SYSTEM

A. In cooperation with control manufacturer’s representative, set and adjust automatically operated devices to achieve required sequence of operations.

B. Testing organization shall verify all controls for proper calibration and list controls requiring adjustment by control system installer.

3.06 COORDINATION

A. Coordinate work with other trades to ensure rapid completion of the project.

B. Deficiencies noted during the course of air balancing in the mechanical installation shall be promptly reported to the Architect to allow corrective action to proceed.

C. Periodic review of progress shall be provided as requested.

END OF SECTION

SECTION 23 0700

INSULATION FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Pipe Insulation
   2. Ductwork Blanket Insulation
   3. Duct Insulation, Internal
   4. Duct Enclosure, Fire Rated
   5. Accessories Piping
   6. Accessories Ductwork

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0529, Hangers, Supports and Anchors for HVAC

D. Section 23 3101, HVAC Ducts and Casing – Low Pressure

E. Section 23 3102, HVAC Ducts and Casing – Medium Pressure

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Prohibit insulating products from containing pentabrominated, octabrominated, and decabrominated diphenyl ethers. Where products within this specification contain these banned substances, provide complying products from approved manufacturers with equal performance characteristics.
   2. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723 or ASTM E84.
   3. Energy Codes: Local Building and Energy Codes govern where insulation performance requirements for thickness exceeds thickness specified.

B. Protection:
   1. Protect against dirt, water, chemical, or mechanical damage before, during, and after installation.
   2. Repair or replace damaged insulation at no additional cost.

C. Source Quality Control:
   1. Service: Use insulation specifically manufactured for service specified.
   2. Labeling: Insulation labeled or stamped with brand name and number.
   3. Insulation and accessories not to provide nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin, not to react corrosively with equipment, piping, or ductwork, and asbestos free.

1.04 SUBMITTALS

A. Submit the following.
   1. Product Data: For each type including density, conductivity, thickness, jacket, vapor barrier, and flame spread and smoke developed indices.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pipe Insulation:
   1. Fiberglass:
      a. Johns Manville Microlok HP
   2. Calcium Silicate:
      a. Johns Manville Thermo-12 Gold

3. Elastomeric:
    a. ArmacellAP Armaflex
    b. Rubatex
    c. K-Flex
4. Cellular Glass:
    a. Pittsburgh Corning Foamglas
    b. Pittwrap SS Jacket

B. Ductwork Blanket Insulation:
1. Fiberglass:
    a. Johns Manville Microlite Type 100
2. Semi-Rigid Fiberglass:
    a. Johns Manville Micro-Flex
3. Elastomeric:
    a. Armacell Armafle

C. Duct Insulation, Internal:
1. Round Ductwork:
    a. CertainTeed
    b. Johns Manville
2. Rectangular Ductwork:
    a. CertainTeed
    b. Johns Manville
    c. Knauf
    d. Owens Corning

D. Duct Enclosure, Fire Rated:
1. Johns Manville
2. Firemaster
3. Fyrewrap

2.02 PIPE INSULATION

A. Fiberglass:
1. Split sectional or Snap-On type.
2. Thermal Conductivity: 0.23 maximum K-factor at 75 degrees F mean temperature determined in accordance with ASTM C335.
3. Maximum Service Rating: 850 degrees F.
4. White vapor barrier jacket with pressure sensitive closure system.

B. Calcium Silicate:
1. Sectional, 14 pcf nominal density.
2. Thermal Conductivity: 0.40 maximum K-factor at 300 degrees F mean temperature determined in accordance with ASTM C335.
3. Maximum Service Rating: 1200 degrees F.

C. Elastomeric:
1. Expanded closed cell with fitting covers and paintable surface.
2. Thermal Conductivity: 0.27 maximum K-factor at 75 degrees F mean temperature determined in accordance with ASTM C335.
3. Maximum Service Rating: 220 degrees F.
4. Color:
    a. Concealed Locations: Black
    b. Exposed Locations: White.

2.03 DUCTWORK BLANKET INSULATION

A. Fiberglass: 1.0 pcf nominal density, 0.25 per-inch maximum K-factor at 75 degrees F mean temperature, 250 degrees F minimum operating temperature limit.
   1. Exposed: FSK facing (foil scrim Kraft) or vinyl - white appearance.
   2. Concealed with Vapor Barrier: FSK reinforced foil and paper.
   3. Concealed without Vapor Barrier: Facing not required.

2.04 DUCT INSULATION, INTERNAL

A. Fiberglass Duct Liner.
   1. Thermal Conductance: k-0.23 in accordance with ASTM C518 and ASTM C177 at 75 degrees F mean temperature.
   2. Maximum Operating Temperature: 250 degrees F as determined by ASTM C 411.
   3. Maximum Air Velocity: 6,000 fpm as determined by ASTM C 1071.
   4. Fungi Resistance:
      a. Does not breed or promote as determined by ASTM C1338.
      b. No growth as determined by ASTM G21.
   5. Bacteria Resistance: No growth as determined by ASTM G22.
   6. Flame-spread index of 25 or less as determined by ASTM E 84 or UL 723.
   7. Smoke development index of 50 or less as determined by ASTM E 84 or UL 723.
   8. Acoustical Absorption Coefficients:
      a. NRC value as tested in accordance with ASTM C423, type A mounting:
         1) 1-inch thickness: Minimum NRC 0.70
         2) 2-inch thickness: Minimum NRC 0.90

2.05 DUCT ENCLOSURE, FIRE RATED

A. Johns Manville:
   1. 2-hour Rated: Johns Manville, Super Firetemp M, minimum 3-inch thickness, ASTME2336, 2-hour rated assembly.
   2. 1-hour Rated: Johns Manville, Super Firetemp L, minimum 2-1/4-inch thickness, ASTM E2336, 1-hour rated assembly.
   3. Joint: Johns Manville, Super Calstik adhesive, modified sodium silicate adhesive.

B. Firemaster: Thermal Ceramics Firemaster duct wrap ceramic fiber blanket, minimum 3-inch total thickness, ASTM E2336, 2-hour rated assembly.

C. Fyrewrap: Unifrax Firewrap duct wrap fiberglass blanket, 1-1/2-inch thickness for 1-hour rated assembly, 3-inch thickness for 2-hour rated assembly. ASTM E2336.

2.06 ACCESSORIES PIPING

A. Adhesives:
   1. General: Maximum Flame Spread/Smoke Developed Rating of 25/50, SCAQMD Rule 1168 compliant.
   2. Fiberglass: Integral closure system.
   3. Calcium Silicate: Benjamin Foster 30-36.
   4. Elastomeric: Armacell 520 BLV.

B. Cements:
   1. Insulating: Ryder.
   2. Heat Transfer: Chemax Tracit-300.

C. Wire Mesh: 1-inch mesh with 20 gauge annealed steel wire.

D. Pipe Fitting Covers: One piece PVC insulated pipe fitting covers. Zeston, Ceel-Co.

E. Grooved Coupling Insulation: One piece PVC insulated fitting cover. Zeston, Ceel-Co.

F. Metal Pipe Jacket: 0.016-inch thick aluminum jacket with formed fitting covers, aluminum snap straps and sealant.

G. Cloth Facing: Presized fiberglass cloth.

H. Tapes: Pressure sensitive, weather resistant, and for temperatures up to 150 degrees F. Zeston Z-tape.

I. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the PVC fitting covers, elastomeric, aluminum facing, Kraft paper, tapes, and adhesives.

2.07 ACCESSORIES DUCTWORK

A. Adhesives:
   1. General: Maximum Flame Spread/Smoke Developed Rating of 25/50, SCAQMD Rule 1168 compliant.
   2. Fiberglass: Benjamin Foster 85-62, Design Polymerics 2501/2502
   3. Elastomeric: Armacell 520 BLV
   4. Duct Insulation, Internal: Foster 85-62, Design Polymerics 2501/2502

B. Weld Pins: Duro-Dyne with NC-1 nylon stop clips

C. Cements:
   1. Insulating: Ryder.
   2. Heat Transfer: Chemax Tracit-300

D. Wire Mesh: 1-inch mesh with 20 gauge annealed steel wire.

E. Mastic: Chicago Mastic:
   1. Vapor Barrier: 17-475
   2. Outdoor Mastic: 16-110 white

F. Cloth Facing: Presized fiberglass cloth

G. Tapes: Pressure sensitive, weather resistant, and for temperatures up to 150 degrees F. Zeston Z-tape.

H. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the PVC fitting covers, elastomeric, aluminum facing, Kraft paper, tapes, and adhesives.

PART 3 EXECUTION

3.01 GENERAL

A. Workmanship:
   1. Installation: Insulation installed in first class, neat professional manner.
   2. Applicators: Employ by firm that specializes in insulation work.

B. Preparation: Surfaces of piping, ductwork, and equipment clean, free of oil or dirt, and dry before insulation is applied.

C. Stamps: ASME stamps, UL labels, and similar stamps and labels not covered.

3.02 HVAC PIPE AND EQUIPMENT INSULATION APPLIED LOCATIONS

A. Insulation Applied Locations – HVAC Piping:

System	Pipe Size	Insulation Type	Insulation Thickness	Notes
Heating Water and Dual Temperature Water (to 140 degrees F)	1-1/4-inch and smaller	Fiberglass	1-inch	
Heating Water and Dual Temperature Water (to 140 degrees F)	1-1/2-inch and above	Fiberglass	1-1/2-inch	
Chilled Water	4-inch and above	Fiberglass	1-inch	Note 1
Pre-Insulated Chilled Water	4-inch and above	Polyurethane foam	1-inch	Note 2
Refrigerant Suction Hot Gas	1-1/4-inch and smaller	Elastomeric	1-inch	

System	Pipe Size	Insulation Type	Insulation Thickness	Notes
Air Separators	All	Fiberglass	2-inch	
Air Separators	All	Elastomeric	2-inch	
Note 1: Cover with metal pipe jacket where exposed to weather and over heat trace cable. Note 2: Refer to specification 23 20 14 for additional pre-insulated piping systems requirements.				

B. Include fittings, unions, flanges, mechanical couplings, valve bodies, valve bonnets, piping through sleeves, except valve bonnets, unions and flanges need not be insulated on the following systems:
   1. Dual temperature and heating water inside building.

C. Piping insulation is not required between the control valve and coil on run-outs when the control valve is located within 4-feet of the coils and the pipe size is 1-inch or less.

D. Valves, and irregular fittings insulated with section of pipe insulation and insulating cement, securely fastened, and finished with 6 ounces canvas and Foster 30-36 lagging adhesive.

E. Option on flanges, valves, strainers, not requiring a vapor barrier to insulate with removable replaceable pads fabricated of 1-inch layer of Pittsburgh Corning Temp Mat sandwiched between inner and outer layer of 8 ounces glass cloth held together with stainless staples with sufficient stainless lacing hooks to hold pad firmly to flange or valve with minimum 3-inch overlap onto adjacent pipe insulation using 18 gauge SS lacing wire.

3.03 PIPING INSTALLATION

A. General:
   1. Joints: Coat both sides of complete joining area with applicable adhesive.
      a. Longitudinal Joints: Make joints on top or back of pipe to minimize visibility. Except foam plastic, seal with closure system or 3-inch wide tape.
      b. Butt Joints: Butt lightly together and, except for foam plastic, seal with 3-inch wide tape or butt straps.
      c. Multiple Layered Insulation: Joints staggered.
   2. Access: Strainer and other items requiring service or maintenance with easily removable and replaceable section of insulation to provide access.
   3. Voids:
      a. Fill voids, chipped corners and other openings with insulating cement or material compatible with insulating material.
      b. In insulation with Heat Tracing: Where piping is shown or specified to be heat traced, bed heat tape into heat transfer cement with insulation over heat tape and cement.
   4. Seal joints, seams, and fittings of metal watertight jackets at exterior locations.

B. Fiberglass Insulation: Exterior insulation encased in metal jacket.

C. Calcium Silicate Insulation:
   1. Secure with 18-gauge wire embedded into insulation.
   2. On systems with vapor barrier, coat complete with vapor barrier mastic.
   3. Cover with cloth facing secured with applicable adhesive.
   4. Exterior insulation encased in metal jacket.

D. Elastomeric Insulation:
   1. Slit full length and snap around pipe.
   2. Make cuts perpendicular to insulating surface leaving no cut section exposed.
   3. Do not stretch insulation to cover joints or fittings.
   4. Seal joints in elastomeric insulation with adhesive.
   5. Exterior insulation painted with two coats of specified paint in accordance with the manufacturer’s instructions and encase in metal jacket.
   6. Sealing joints with tape will not be allowed.

E. Polyurethane Foam Insulation (pre-insulated piping):
   1. Install per manufacturer's instructions.
   2. Factory apply insulation and jacket to carrier piping and fittings.
   3. Spray applied or injected with one shot into the annular space between carrier pipe and jacket
   4. Liquid and vapor tight insulation.

F. Fittings: Insulation specified with continuous vapor barrier, the vapor barrier must not be violated.
   1. On Elastomeric Insulation: Fittings covered with covers made up of mitered sections of insulation or with formed pipe fitting covers.
   2. In Other Insulation: Fittings covered with insulation to the same level of the adjoining insulation or fill with insulating cement. Finish with pipe fitting covers or cloth facing and tape.

G. Unions, Mechanical Joints, Valves, etc.:
   1. General:
      a. As specified for fittings.
      b. Minimum thickness same as specified for piping.
   2. Unions: Build up insulation at least 1/2-inch beyond adjoining insulation.
   3. Flanges: With square corners. Where flanges are not insulated, terminate adjacent insulation so flange bolts can be removed.
   4. Flanged Valves: Insulation with square corners.

H. Vapor Barrier Insulation:
   1. Refer to Section 23 0529 Hangers, Supports, and Anchors for HVAC, for support requirements.
   2. Piping which requires vapor barrier protection has a continuous vapor barrier, which may not be pierced or broken. The following piping systems require vapor barrier protection:
      a. Chilled water including radiant cooling water.
      b. Brine water.
      c. Refrigerant suction.
      d. Other piping systems with a nominal operating temperature below 65 degrees F.
   3. Vapor Barrier Insulation.
      a. Insulation for pipe requiring vapor barrier protection 1-1/4-inch or smaller, insulation continuous through pipe hangers and rollers.
      b. For pipe 1-1/2-inch and larger, 18-inch section of calcium silicate, same thickness as pipe insulation with continuous vapor barrier jacket at each hanger or roller. Provide pipe shield specified in Section 23 0529, Hangers, Supports, and Anchors for HVAC.

I. Non-Vapor Barrier Insulation:
   1. Refer to Section 23 0529, Hangers, Supports, and Anchors for HVAC for support requirements.
   2. Insulation may be interrupted at supports. Butt insulation tight to support.
   3. Continue insulation at supports, installation as specified for piping systems with vapor barrier installation.
   4. Void between saddle and pipe filled with insulation.

3.04 EQUIPMENT INSTALLATION

A. General: Install true and smooth. Insulation over curved surfaces conform to curves of surface.
   1. Access:
      a. Insulated removable heads, water boxes, pump casings, access, etc., that require service, inspection or maintenance provided with covers or section that are easily removable and replaceable.
      b. Reinforce openings in adjacent insulation with metal beading.
      c. In vapor barriered insulation, coat joints with vapor barrier mastic.

2. Voids, Depressions and Cavities: Voids, chipped corners and other openings filled with insulating cement or material compatible with insulating material.
3. Vapor Barriered Insulation:
   a. Where insulation is specified to have a vapor barrier.
   b. No broken or pierced barrier.
      1) Coated with vapor barrier mastic and patched with insulation facing or tape.
      2) Staples brush coated with vapor barrier coating.
      3) Raw edges coated with vapor barrier mastic covered and cover sealed to equipment surface.
4. Non-Vapor Barriered Insulation:
   a. Patch with insulation facing or tape.
   b. Cover raw edges and neatly bevel to the equipment surface.
5. Multilayered Insulation: With staggered joints.

B. Elastomeric Blanket:
1. Cut insulation to size, make corners with mitering cuts to preclude raw edges, continuously cement insulation to equipment with adhesive.
2. Cement both surfaces of joints and butt tightly together and cover raw edges with two coats of adhesive.

3.05 DUCT INSULATION APPLIED LOCATIONS

A. General:
1. Provide external insulation with continuous vapor barriers unless specifically noted otherwise.
2. Internally line ductwork completely to grille or diffuser or to indicated terminal points. Dimension shown are net inside of liner.
3. Internally lined ductwork need not be externally insulated.
4. In addition to locations described in specification, internally line medium, low, return and exhaust air ductwork where shown on drawings.
5. Internal lining is not allowed downstream of final filters in systems serving inpatient healthcare facilities.

B. Insulation Applied Location – HVAC Ductwork:

System	Location	Duct Type	Insulation Type	Thickness	Notes
Medium Pressure Supply*	Exposed or Visible (Including above a cloud ceiling)	Rectangular	Internally Lined	1-1/2-inch	
		Round/Oval	Internally Lined	1-1/2-inch	
	Concealed or in mechanical rooms	All	Fiberglass Blanket	1-1/2-inch	
	15-feet upstream and downstream of fans	All	Internally Lined	1-1/2-inch unless otherwise indicated	
Low Pressure Supply*	Exposed or Visible (Including above a cloud ceiling)	Rectangular	Internally Lined	1-1/2-inch	
		Round	Internally Lined	1-1/2-inch	
	Concealed or in mechanical rooms	All	Fiberglass Blanket	1-1/2-inch	

System	Location	Duct Type	Insulation Type	Thickness	Notes
	Downstream of Air Terminal Units	All	Internally Lined	1-1/2-inch	Note 1
	15-feet upstream and downstream of fans	All	Internally Lined	1-1/2-inch unless otherwise indicated	
Return Air* (not insulated except)					
	15-feet upstream and downstream of fans	All	Internally Lined	1-inch unless otherwise indicated	
Exhaust Air* (not insulated except)	15-feet upstream and downstream of fans	All	Internally Lined	1-inch unless otherwise indicated	
	In Toilet Rooms, 10-feet downstream of exhaust grilles	All	Internally Lined	1-inch	
Outside Air (untempered)	Exposed or Visible (Including above a cloud ceiling)	Rectangular	Internally Lined	2-inch	
		Round	Internally Lined	2-inch	
	Concealed or in mechanical rooms	All	Fiberglass Blanket	2-inch	
Supply and Return Plenums	All	All	Internally Lined	2-inch	Note 2
Grease Hood Exhaust	All	All	Duct Enclosure, Fire Rated	As Indicated	
Transfer Air	All	All	Internally Lined	1-inch	
OSA and Relief Plenums at Louvers	All	All	Fiberglass Blanket	2-inch	Note 1

* In addition to applied locations listed in this table, provide internally lined ductwork where indicated on drawings.
Note 1: Except ductwork downstream of terminal units serving patient care areas in hospitals
Note 2: Insulation not required on factory fabricated insulated housings and plenums (AHP).

3.06 DUCTWORK INSTALLATION

A. General:
1. Install in accordance with manufacturer's instruction.
2. Continuous vapor barrier. Coat with vapor barrier mastic and patch with facing or tape. Joints between insulation and access with vapor barrier mastic.
3. Insulation at access panels to be removable or attached to panel with edges of panel and opening reinforced with metal beading.

B. External Blanket Insulation:
   1. Insulation secured to ductwork with 20-gauge snap wires 24-inches on center and at all joints.
   2. Joints and seams lapped a minimum of 3-inches and sealed with jacket tape.

C. Internal Duct Liner:
   1. Air stream coated surface.
   2. Weld pins spaced maximum of 15-inch on center in both directions and within 2-inches of corners and joints. Weld pins flush with liner surface.
   3. Complete duct surface coated with adhesive and insulation pressed tightly thereto.
   4. Provide edges at terminal points with metal beading and heavily coated with adhesive.
   5. Heavily coat joints and corners with adhesive.
   6. Damaged areas replaced or heavily coated with adhesive.

D. Duct Enclosure - Fire Rated:
   1. Installation: Per manufacturer's instructions.
   2. Joints:
      a. Cement attached boards to one another.
      b. Butter mating surfaces with a 1/8-inch layer adhesive.
      c. Secure fiberglass type material with stainless steel banding, Type 304.
   3. Support:
      a. Duct enclosure may be hung from a conventional trapeze arrangement.
      b. Provide adequate support at the bottom of vertical runs.
      c. Multi-Story Vertical Runs: Support Firetemp enclosure at each story penetration with an angle iron collar attached to the Firetemp.
   4. Expansion: Provide adequate clearance at the end of straight runs to allow for expansion of the metal duct inside the enclosure.

E. Plenums: Insulation on floors protected by wire mesh.

F. Blank-Off Panels: Insulation, enclosed with sheet metal on all sides. Joints with vapor barrier mastic and taped.

G. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep, and finish edges to maintain vapor barrier and to prevent damage to the insulation.

3.07 DUCT, PIPE AND TERMINAL UNIT ACOUSTICAL WRAP

A. Installed in accordance with the manufacturer's instructions.

B. Applied locations for piping and duct systems:
   1. Variable and constant volume terminal units with maximum air volumes over 2000 cfm. Wrap installed such that control devices are easily accessible without circumventing the acoustical value.
   2. Where specified or indicated on drawings.

3.08 FIELD QUALITY CONTROL

A. Field Test: Test and approve systems prior to installation of insulation.

END OF SECTION

SECTION 23 0800
COMMISSIONING

PART 1 GENERAL

1.1 SUMMARY

A. The commissioning process is described in Section 01 91 00 Commissioning.

B. Provide all labor and materials required to complete the commissioning of those Division 23, HVAC systems and equipment identified as Commissioned Systems and Equipment in Section 01 9100 Commissioning.

1.2 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 01 9100 Commissioning.

1.3 SUBMITTALS

A. Refer to Section 01 9100 Commissioning.

1.4 COMMISSIONING SCOPE OF WORK - COMMISSIONING AGENT

A. Refer to Section 01 9100 Commissioning.

1.5 COMMISSIONING SCOPE OF WORK - CONTRACTOR

A. Refer to Section 01 9100 Commissioning.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Refer to Section 01 9100 Commissioning.

PART 3 EXECUTION

3.1 MEETINGS

A. Refer to Section 01 9100 Commissioning.

3.2 INSTALLATION, CHECK-OUT, START-UP AND PREFUNCTIONAL CHECKS

A. Refer to Section 01 9100 Commissioning.

3.3 FUNCTIONAL TESTING

A. Refer to Section 01 9100 Commissioning.

3.4 TRAINING OF FACILITY OPERATING STAFF AND BUILDING OCCUPANTS

A. Refer to Section 01 9100 Commissioning.

END OF SECTION

SECTION 23 0900

CONTROLS

PART 1 GENERAL

1.01 WORK BY CONTRACTOR – RESPONSIBILITY MATRIX

A. Owner is contracting direct with the Controls Installer.

B. The following information is provided to coordinate scope required by the Contractor with the scope of the Owner's Controls Installer.

C. Contractor to coordinate/provide all project updates, coordination meetings, change documents (RFIs, CCD's, ASI's, etc.), schedules, startup, test and balance activities with/to the Owner's Controls Installer.

ESD 4J/Contractor Responsibility Matrix			
	Furnish	Install	Notes
Controls System	ESD 4J	ESD 4J	
DDC Control Panel through devices, including terminations at said devices as a complete system. System includes including power supplies, boards/modules, pathway/raceway, and low voltage wiring.	ESD 4J	ESD 4J	*Room temperature/carbon dioxide sensor rough in to accessible ceiling space by Contractor.
Line Voltage to DDC Power Supplies	C	C	
Temperature Instrument Wells	ESD 4J	C	*Unless provided by manufacturer of Contractor purchased equipment, specific for their sensing equipment.
Piping Pressure Transmitters/Transducers	ESD 4J	C	
Motorized Control Dampers	C	C	
Motorized Control Valves	ESD 4J	C	
Damper and Valve Actuators	ESD 4J	ESD 4J	*If spec or equipment schedule states to provide with equipment then furnish will be by manufacturer.
Vortex Shedding Water Flow Meter	C	C	*ESD 4J to provide control wiring
Lighting Control Panel	ESD 4J	C	
ESD 4J – Eugene School District 4J's Controls Contractor			
C-Contractor			

1.02 FOR REFERENCE ONLY - SCOPE OF WORK (OWNER'S CONTROLS CONTRACTOR)

A. General Note: The scope of work for HVAC controls work in this contract is different than is traditional in new construction. Specifically, instead of turnkey controls installation, the requirements of this contract are for physical installation of the control system only; determination of sequences-of-operation, the programming required to achieve said sequences, graphics, and database setup are outside this contract and will be provided by Owner. All other required work for a fully functioning control system are within the contract.

B. Provide hardware installation of Automated Logic DDC System for the Project, to control HVAC and exterior lighting as identified in ESD 4J provided points list. Substantial completion as per contract, is defined as being complete with point checkout completion.

C. Provide wiring installation diagrams for field installers and to serve as O&M drawings at end of project. Submit wiring diagrams along with submittal information for products to be installed for review and receive approval prior to beginning field installation work. Provide valve schedule and temperature well submittal information to installing contractor in timely manner.

D. Furnish control valves, wet differential pressure transducer, and temperature wells, to be installed by contractor. Furnish and install required control cabinets, power supplies, control module cards, lighting panels, wire and raceway, room sensors, discharge and mixed air sensors, CO2 sensors, outside air sensors, CTs, pressure transducers, relays, valve/damper actuators and other I/O devices and terminations as required for a fully functional control system. Follow manufacturer's installation instructions for all devices and aspects of system.

E. Coordinate with Owner, Owner's general contractor and subcontractors as required to complete the scope of work within the published schedule. Furnish installed by the building contractor or their tier contractors in a timely fashion as required to prevent schedule impacts. Participate in the General Contractor MEP coordination for installation of your work and sharing of wire tray and other common raceways when possible.

F. Power supply locations have been identified on the project drawings, confirm, and coordinate locations with the electrical subcontractor to provide line voltage power.

G. Perform point-to-point system commissioning and record on appropriate WebCtrl "properties" page. As noted below, Owner will setup database and will provide programs/graphics in database ready for download to modules by control contractor as modules are brought on-line.

H. During course of installation work, mark up wiring diagrams to reflect any and all "as-built" conditions that vary from the drawings. Consult district engineer for prior approval of any substantial changes from approved wiring installation drawings. At end of project, submit edited version of wiring diagrams incorporating field markup as the final O & M drawings.

I. Provide one-year warranty on installation, two years on control modules.

J. All line-voltage/low voltage wiring not in concealed ceiling spaces or wall cavities in conduit, placed to achieve the best aesthetics, and in accordance with electrical code. Conduit wiring in mechanical rooms. Coordinate installation timeline such that painted areas are complete prior to the painting process.

K. Pilot duty relays used with starters have a HOA switch if the starter (provided by others) does not have an HOA switch (RIB model U1S). If the existing starter does have an H-O-A already, pilot duty relay should not include that feature (RIB model U1C)

L. Where small loads are directly switched with DDC-controlled relay, such as small exhaust fan motors, provide a relay with 20A-rated contacts and H-O-A switch (RIB model 2401SB or similar as required by power source).

M. CTs on direct drive fan motors, fixed threshold (RIB XGF). CTs on belt driven equipment and EC motors, adjustable threshold (RIB XGA or Veris H608).

N. Run proof on VFDs may utilize the VFDs integral run proof binary output contacts, or (preferred) analog speed output contacts.

O. Label universal input and output wiring at module to match wiring diagrams.

P. Auto reset freeze stats.

Q. Mixed Air Sensors: Duct averaging.

R. Actuators:
   1. Manufacturer: Belimo
   2. Valves characterized flow t2 and 3 way valves and do not require spring return actuators.
   3. Dampers on air handlers less than 2000 cfm only require a spring return actuator on outside air damper and any direct relief to the outdoors.
   4. RA may be either spring return or non-spring.
   5. Units larger than 2000 cfm require coordinated spring return actuators on mixed air dampers.

S. Power supplies outside of module cabinet to reduce heat buildup in cabinet. Power supplies include provisions to switch off 24VAC power inside of module cabinet and have overload protection on both primary and secondary side of transformer. Switches and overload devices behind covers to prevent student or staff access to said switches without tools. Typical models used: RIB PSH300A, PSH500A, PSC100AB10.

T. This project is a prevailing wage job. Oregon prevailing rate of wage for this project are those shown in the Project Manual Section 00 7300 referenced BOLI publication.

1.03 REFERENCE ONLY - WORK BY OWNER

A. Owner will set up database as required.

B. Owner will generate and load programs into database for all modules to facilitate contractor's point testing/commissioning. Graphics will also be the responsibility of Owner.

C. Sequence of operation, as determined by the Owner's programming will be solely the responsibility of Owner.

D. Commissioning agent will be checking/verifying point-to-point checkout.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 23 0993

EQUIPMENT OPERATIONAL INTENT

PART 1 SEQUENCE OF OPERATIONS

1.01 GENERAL

A. This section provides a simplified description of system control intent and is meant to be informational, to assist with coordination of mechanical work and the Owner's controls work.

1.02 TYPICAL CLASSROOM AIR HANDLER WITH NO RETURN FAN

A. Applies to typical classrooms units such as AH-A107

B. General:
   1. The air handler provides chilled water cooling or hot water heating, and ventilation to the room.
   2. The unit includes supply fan with EC motor for speed control.
   3. Integral outside air and return air dampers with factory-furnished Belimo modulating actuators maintain minimum OSA in response to wall-mounted CO2 sensor and allow up to 100 percent OSA for economizer cooling.
   4. During economizer cooling remote auto damper connected to return duct in mechanical room or attic opens to relieve excess air from room.
   5. Fan speed is varied depending on heating or cooling load and supply air temperature.
      a. Mechanical Cooling Mode: CFM equal or less than the scheduled cooling cfm.
      b. Economizer Cooling Mode: CFM ramps up to the maximum (economizer).
      c. Heating Mode: CFM reduced to minimum needed for non-stratified air distribution.

1.03 SINGLE ZONE UNITS, NON-CLASSROOM

A. Applies to:
   1. AH-ENTRY
   2. All air handlers serving hallways

B. General:
   1. Air handling unit provides heating or cooling and economizer cooling to the room(s)
   2. Air handler includes supply fan and return/relief fan with EC motors for speed control.
   3. Air flow varies depending on heating or cooling load.
   4. Outside air is determined by preset minimum. During economizer, air is relieved into the mechanical attic and out through relief louver.

1.04 SINGLE ZONE UNITS WITH DCV

A. Applies to:
   1. AH-GYM (Main Gym)
   2. AH-MUSIC
   3. AH-MEDIA (Media/Library)
   4. AH-CAFE

B. General:
   1. Air handling unit provides heating or cooling and economizer cooling only to the room(s).
   2. RTU includes supply fan with EC motors or VFD for speed control.
   3. Air flow varies depending on heating or cooling load.
   4. Outside air is determined by preset minimum and to maintain CO2 setpoint. During economizer, air is relieved into the mechanical attic and out through relief louver.

1.05 MULTIPLE ZONE VAV WITH TERMINAL UNITS AND DUCT COILS

A. Applies to:
   1. AH-ADMIN (Administration)
   2. Terminal units
   3. Duct coils

B. General:
   1. Air handling unit provides heating or cooling and economizer cooling. Based on feedback from the zones, the air handler delivers partially heated or cooled air to the terminal units and duct coils.
   2. Terminal units regulate supply air quantity to each zone. Zones with CO2 sensors increase supply air to zone provided zone is not overheated or overcooled.
   3. Duct coils provide additional heating or cooling.
   4. Air handler supply fan speed is set to maintain static pressure setpoint in supply duct.
   5. Outside air is determined by preset minimum and increased if needed to satisfy CO2 setpoint at zones with DCV. During economizer, air is relieved into the mechanical attic and out through relief louver.

1.06 SPLIT SYSTEM COOLING

A. Applies to:
   1. IDF and MDF room cooling systems including exhaust fan.
   2. Electrical room cooling systems including exhaust fan.

B. General:
   1. DX Cooling or economizer cooling is provided by 2-stage split system with horizontal fan coil unit located outside the space, and condensing unit located in mechanical room or attic.
   2. Mixing box or duct-mounted auto dampers provide economizer cooling. Outside air damper, return damper and exhaust damper included.
   3. When outside air temperature is higher than room temperature the system operates in mechanical cooling mode and outside air damper and exhaust air damper are closed. Exhaust fan (if provided) is off. Return air damper is open.
   4. When in economizer or combined mechanical/economizer cooling mode, outside air damper, return air damper, and exhaust air damper modulate to provide the needed supply air temperature to meet the load. Exhaust fan (if provided) modulates along with the dampers to maintain neutral room pressurization.
   5. If there is no exhaust fan, return air is relieved to the mechanical room or attic via the exhaust/relief auto damper.
   6. The fan coil unit runs at constant speed. The system is allowed to cycle off if the load is satisfied. System is enabled continuously.

1.07 KITCHEN

A. Applies to:
   1. Cafe – Cafeteria air handlerAH-KITCH – Kitchen air handler
   2. KEF-GREASE – Kitchen Type 1 hood exhaust fan
   3. KEF-DISH – Kitchen dishwash hood exhaust fan

B. General:
   1. Cafeteria air handler provides heating or cooling, and ventilation to Cafeteria.
   2. Cafeteria air handler includes supply fan fan with VFD for speed control.
   3. Air flow varies depending on heating or cooling load.
   4. Outside air is determined by preset minimum and to maintain CO2 setpoint. During economizer, air may be relieved into the mechanical attic and out through relief louver.
   5. Cafeteria air handler supply airflow and outside airflow is as required to satisfy heating or cooling load in cafeteria, and as needed to provide makeup air to the kitchen hoods. Kitchen pressurization with respect to commons is measured. Makeup air is transferred from the cafeteria to the kitchen.
   6. Kitchen air handler provides heating and cooling to the kitchen. This unit is allowed to recirculate since it does not deliver air to any spaces other than the kitchen.
   7. Normally kitchen is warmed up with the kitchen air handler in 100 percent recirculation mode. The unit is also capable of running at 100 percent outside air if desired. In this case the integral return/exhaust fan maintains room pressurization or the air is used as makeup for the kitchen hoods.

8. If no heating or cooling are required in the kitchen the air handler may be shut off.
9. Kitchen type 1 and type 2 fans operate manually at constant speed. Kitchen DCV is not required by Code for this kitchen.

1.08 EXHAUST FANS, CONSTANT VOLUME

A. General:
1. EF-LSKIL – Runs when the life skills air handler is in occupied mode.
2. EF-KILN – Interlock with kiln operation and local kiln exhausters that discharge under the hood. Provide for time delay to continue fan operation for a set time after kilns are turned off.
3. EF-CUSTODIAL – Run during normal occupied hours.
4. EF-JAN2 – Run during normal occupied hours.
5. EF-RRA – Run when lights are on in either restroom. Timed delay off.
6. EF-RRB – Run during normal occupied hours
7. EF-RRCOM – Run during normal occupied hours.
8. EF-ELECA – Run as needed to maintain cooling temperature set point in Sub-Electrical Room.
9. EF-ELECB – Run as needed to maintain cooling temperature set point in Main Electrical Room.
10. EF-IDFA – Run as needed to maintain cooling temperature set point in IDF Room.
11. EF-IDFC – Run as needed to maintain cooling temperature set point in IDF Room.
12. EF-TECH – Run as needed to maintain cooling temperature set point in Technology Support Room.
13. EF-EMERG – Runs as needed to maintain cooling temperature set point in Emergency Electrical Room. Continuously enabled.
14. EF-LSDRY – Automatically runs when pressure is sensed. Sensor furnished with fan.
15. KEF-GREASE – Manually operated from either kitchen grease hood.
16. KEF-DISH – Manually operated from switch at kitchen dishwash hood.

1.09 DOMESTIC WATER HEATING:

A. Domestic hot water circulation pump shall be enabled during building occupied periods.

B. Domestic water heater shall operate to maintain tank temperature setpoint of 140 degrees F.

C. Failure Alarms:
1. Generate an alarm upon pump failure.
2. Generate an alarm upon tank temperature falling below 80 degrees F.

1.10 DUAL TEMPERATURE HEATING/COOLING SYSTEM

A. Applies to:
1. Boilers Boiler 1, Boiler 2
2. Air Cooled Chiller Chiller 1
3. Pumps Pump 1, Pump 2

B. General:
1. Heating Mode:
a. Boiler sequencing panel shall be furnished with boilers. Panel controls pumps, boiler firing rate, alternates units, opens boiler isolation valves.
b. Chiller is locked out.
c. 3-way butterfly control valve closes flow to the chiller, allowing all flow to the boilers.
d. Two boilers are sized for the full expected heating load.
e. One pump is sized for the full heating load at 100 percent speed. Pump VFD may ramp down to its minimum allowed 20 percent of full speed, which exceeds the minimum allowed flowrate for one boiler.
f. Boiler supply water temperature is reset based on outside air temperature.
g. End of line bypass valves maintain the minimum flowrate required for pump.
h. Central flowmeter reports flowrate.

2. Cooling Mode.
    a. Chiller operation is directed by its own control panel.
    b. Boilers are locked out.
    c. 3-way butterfly control valve closes flow to the boilers, allowing all flow to the chiller.
    d. Chiller is sized for the peak expected cooling load.
    e. Both pumps must run at 100 percent speed to satisfy full load. At low loads both pumps run at reduced speed or one pump runs at high speed to satisfy coil loads.
    f. End of line bypass valves and 3-way valves together maintain the minimum flowrate of 100 gpm required for the chiller.
    g. Central flowmeter reports flowrate.

END OF SECTION

SECTION 23 2014

PREFABRICATED PIPING SYSTEMS FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Prefabricated HDPE Chilling Water Piping

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0590, Pressure Testing for HVAC Systems

D. Section 23 0700, Insulation for HVAC

E. Section 23 2113, Pipe and Pipe Fittings HVAC

1.03 SUBMITTALS

A. Submit the following:
   1. Product Data
   2. Installation Manuals
   3. Complete shop drawings for piping systems including elbows, tees, flanges, coupling locations, and anchors. Include cutting lengths and thrust block sizes.
   4. Factory test report for each concealed weld location. Identify each section of piping with a unique number to allow for easy comparison with test report.
   5. Report on field piping tests with signatures of Architect and manufacturer's representative witnessing.

1.04 QUALITY ASSURANCE

A. Provide the services of a qualified manufacturer's representative to instruct the contractor on the installation procedures for piping, and to be present on site to assist during critical stages of installation and testing.

B. Include a report consisting of the installation log indicating actual installed conditions and test certification signed by the manufacturer's representative above, the contractor, and the Architect's representative. Include certification by manufacturer's representative that the installation is in conformance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Prefabricated HDPE Chilling Water Piping:
   1. Rovanco
   2. Thermacore
   3. Perma-Pipe
   4. Thermal Pipe
   5. Insul-pipe
   6. Other Manufacturers: Submit substitution request.

2.02 PREFABRICATED HDPE CHILLED WATER PIPING

A. General:
   1. Provide complete prefabricated underground chilled water piping system suitable for direct burial as indicated on Drawings and as specified herein.
   2. Factory prefabricated HDPE jacketed system of factory pre-insulated pipe with necessary fittings, seals, and accessories.

B. Pipe:
   1. Carrier pipe High Density Polyethylene pipe DR-11, 160 psi minimum working pressure for temperatures up to 110 degrees F.

C. Expansion:
   1. Components of carrier pipe, insulation, and jacket must be able to expand and contract as a unit without overstressing or adversely affecting the materials.
   2. Piping system supplier be responsible for the overall design of the expansion and contraction compensation.

D. End Seals: Direct-buried ends of insulated pipe with exposed insulation will be sealed with polyethylene end seals.

E. Insulation: Specified in Section 23 0700, Insulation for HVAC.

F. Jacket: Outer protective jacket corrugated seamless polyethylene completely encompassing and protecting the insulation from moisture and damage, designed for H-20 loading at a burial depth of 2-foot minimum.

G. Joints:
   1. Straight run joints field-insulated per the manufacturer's instructions, using polyurethane foam poured in an HDPE sleeve and sealed with a heat shrink sleeve.
   2. Joint closures and insulation occurs at straight sections of pipe.
   3. Insulation and jacketing materials furnished by piping system supplier.

H. Fittings: Standard component factory prefabricated and pre-insulated to the thickness specified.

I. Accessories: Provide required accessories including wall sleeves, and miscellaneous materials as required for attachment to steel or copper pipe at ends and as required and detailed to a complete and total installation.

J. Service:
   1. Chilled Water

PART 3 EXECUTION

3.01 PREPARATION

A. Measurements, Lines and Levels:
   1. Check dimension at the building site and establish lines and levels for the work specified in this Section.
   2. Establish inverts, slopes, and manhole elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with Drawings and Specifications.
   3. Use established grid and area lines for locating trenches in relation to building and boundaries.

3.02 EXCAVATION AND BACKFILL

A. General:
   1. Perform necessary excavation and backfill required for the installation of mechanical work in accord with Division 02, Existing Conditions.
   2. Repair pipelines or other work damaged during excavation and backfilling.

B. Excavation:
   1. Excavate trenches to the necessary depth and width, removing rocks, roots, and stumps.
   2. Include additional excavation to facilitate utility crossovers, additional offsets, etc.
   3. Excavation material is unclassified.
   4. Width of trench adequate for proper installation of piping.
   5. Widen trench if not wide enough for a proper installation.

C. Bedding:
   1. Piping on full bed of sand.
   2. Place a minimum 4-inch deep layer on the leveled trench bottom for this purpose.

D. Backfill:
   1. Immediately after piping is installed in the ditch, make a partial backfill in the middle of each pipe length leaving the joints exposed for inspection prior to the hydrostatic tests.
   2. Place in layers not exceeding 8-inches deep and compact to 95 percent of standard proctor maximum density at optimum moisture content. Earth backfill free of rocks over 2-inches in diameter and foreign matter. Disposal of excess material as directed.
   3. Interior: Backfill under interior slabs with bank sand or pea gravel.
   4. Exterior:
      a. Excavated material may be used outside of buildings at the contractor's option.
      b. First 4-inches sand and final 12-inch layer course soil in any event.

3.03 PIPING JOINTS

A. Pipe and fittings be joined using methods and materials specified in Section 23 2113, Pipe and Pipe Fittings HVAC.

3.04 ADJUSTING AND CLEANING

A. General:
   1. Clean interior of al piping before installation.
   2. Flush sediment out of al installed piping systems.

3.05 INSTALLATION OF HDPE CHILLED WATER PIPING

A. Install piping in accordance with the Manufacturer's recommendations and installation Drawings.

B. Install piping as to vent and drain to building.

C. Install system in a manner that will not require expansion loops or compensators of any type.

D. Install system with the fewest number of underground joints possible.

E. Make connection between PEX or HDPE and Copper or Steel pipe according to manufacturer's recommendations.

F. Slope piping uniformly. Record exact location and depth with respect to established datum points.

G. Test piping prior to sealing of conduits and before backfilling. Seal leaks and retest until tight.

H. Utility Marking: Installed over the entire length of the underground piping utilities. Install plastic tape along both sides and the center line of the trenches at the elevation of approximately 12-inches above the top of utility.

I. Trace Wire: Install 16 gauge insulated copper tracer wire (green in color) above buried nonmetallic piping. Tracer wire to run entire length of pipe.

END OF SECTION

SECTION 23 2113

PIPE AND PIPE FITTINGS HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Black Steel Pipe Schedule 40
   2. Copper Pipe
   3. PVC Pipe
   4. Flanged Joints
   5. Unions
   6. Mechanical Pipe Couplings and Fittings
   7. Soldering and Brazing

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 2500, HVAC Water Treatment

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Piping material and installation to meet requirements of the local building codes and serving utility requirements.

B. Grooved joint couplings and fittings products of a single manufacturer. Grooving tools by the same manufacturer as the grooved components.
   1. Castings used for coupling housings, fittings, valve bodies, etc., date stamped for quality assurance and traceability.

C. Pipe Cleaning: Should any pipe be plugged or should foaming of water systems occur, disconnect piping, re-clean, and reconnect without additional expense to the Owner.

D. Correct damage to the building or systems resulting from failure to properly clean the system without additional expense to the Owner.

1.04 SUBMITTALS

A. Submit the Following:
   1. List of piping materials indicating the service it is being used for. Do not submit piping product data.
   2. Product data on mechanical couplings and related components, double wall fuel oil pipe and fittings, and polypropylene waste and vent pipe.
   3. Certificate of completion
   4. Treatment Reports

B. Test Reports and Certificates: Submit certificates of inspections and pipe tests to Owner.

C. Other: Make certified welders' certificates available.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. As indicated.

2.02 BLACK STEEL PIPE, SCHEDULE 40 AND STANDARD

A. Pipe:
   1. Schedule 40 conforming to ASTM A 135 or A 53.
   2. Schedule 40 up to 10-inch diameter.
   3. Standard weight for 12-inch diameter and above.

B. Fittings:
   1. 150 pound screwed malleable iron on 2 inches and below, Schedule 40 welding fittings conforming to ASTM A 234 for 2-1/2 inches and above or mechanical couplings on select piping as herein specified.
   2. Fittings Below Grade: Welding fittings.
   3. Long Radius Elbows: Pumped systems.
   4. Short Radius Elbows: Not acceptable for use except as approved on a case by case basis.

C. Service:
   1. Chilled and heating water piping (up to and including 6-inches).
   2. Dual temperature water piping (up to and including 6-inches).
   3. Safety and relief valve discharge.
   4. Chemical treatment.

2.03 COPPER PIPE

A. Pipe: Hard drawn copper tubing, Class L, ASTM B 88.

B. Fittings:
   1. Wrought copper, 150 psi.
   2. ANSI B16.22 for soldered joints.
   3. ANSI B16.22 or B16.50 for brazed joints.
      a. Manufactures:
         1) Chase
         2) Revere
         3) Mueller
         4) Other Manufacturers: Submit Substitution Request.

C. Service:
   1. Refrigerant piping (Type L, hard drawn, ACR cleaned).
   2. Chilled and heating water piping (Type L, hard drawn) up to and including 4-inches.
   3. Coil condensate drains and traps, cooling tower drains, and other miscellaneous drains.

2.04 PVC PIPE

A. Pipe: Schedule 80 PVC, normal impact, Type 1, ASTM D 1785.

B. Fittings: Schedule 80 PVC, deep socket, solvent welded, ASTM D2467.

C. Service:
   1. Coil condensate drains and traps, cooling tower drains, and other miscellaneous drains.
   2. Water heater combustion air and vent piping.
   3. Except not allowed in return air plenums.

2.05 FLANGED JOINTS

A. Flanged Joints:
   1. Flanges:
      a. Cast iron or steel for screwed piping and forged steel welding neck for welded line sizes.
      b. In accordance with ANSI B16.1; 150 lb. for system pressures to 150 psig; 300 pounds for system pressures 150 psig to 400 psig.
   2. Pressure Rating and Drilling: Match apparatus, valve, or fitting to which they are attached.
   3. Gaskets:
      a. Flanged Services: With the exception of steam and pumped condensate, Garlock 3700 or equal, 1/8-inch thick, non-metallic type.
      b. Steam and Pumped Condensate: Flexitaulic Style CG or equal, 1/8-inch thick, semi-metallic type.

4. Make joint using American Standard hexagon head bolts, lock washers, and nuts (per ASTM A307 GR.B) for service pressures to 150 psig; alloy steel stud bolts, lock washer, and American Standard hexagon head nuts (per ASTM A307 GR.B) for service pressures 150 psig to 400 psig.
5. Use length of bolt required for full nut engagement.
6. Provide electro-cad plated bolts and nuts on cold and chilled water lines.

2.06 UNIONS

A. 150 psi malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing.

B. Dielectric Fittings:
1. Nationally listed, have a dielectric thermoplastic interior lining, and meet requirements of ASTM F1545.
2. Suitable for the pressure and temperature to be encountered.

2.07 MECHANICAL PIPE COUPLINGS AND FITTINGS

A. Acceptable Manufacturers:
1. Victaulic
2. Anvil Gruvlok 7401, 7001
3. Other Manufacturers: Submit substitution request.

B. Couplings: Ductile iron conforming to ASTM A 536, Grade 65-45-12, rust inhibiting paint.

C. Fittings:
1. Ductile iron conforming to ASTM A 536, Grade 65-45-12.
2. Long radius elbows.

D. Bolts and Nuts: Zinc electroplated track head bolts conforming to ASTM A 183.

E. Gasket: Grade E EPDM:
1. Temperature Range: -30 degrees F to 230 degrees F.
2. Flushseal, Installation Ready or Flush Gap configuration.

F. Service:
1. Chilled water.
2. Heating water below 230 degrees F

2.08 SOLDERING AND BRAZING

A. Brazed Joints:
1. Acceptable Manufacturers:
a. Westinghouse Phos-Copper
b. Dyna-Flow by J.W. Harris Co., Inc.
c. Other Manufacturers: Submit substitution request.
2. Applied locations:
a. Below grade piping.
b. Above grade piping larger than 2-inches for the following services:
1) Heating water.
2) Chilled water.
3) Condenser water.
4) Heat recover water.
c. Refrigerant piping: Braze in accordance with Copper Development Association Copper Tube Handbook using BCUP series filler material.

B. Soldered Joints:
1. Acceptable Manufacturers:
a. Wrought Copper Pipe Fittings:
1) All-State 430 with Duzall Flux
2) Engelhard Silvabrite with Engelhard General Purpose Flux
3) J.W. Harris Co.

b. Valves, Cast Fittings or Bronze Fittings:
1) Harris Stay-Silv-15
2) Handy & Harmon Sil-Fos.

2. Applied locations:
a. Above grade piping 2-inch and smaller for the following services:
1) Heating water.
2) Chilled water.
3) Condenser water.
4) Heat recovery water.
5) Industrial cold water.
6) Trap priming lines.

C. Valves, Cast Fittings or Bronze Fittings:
1. Acceptable Manufacturers:
a. Harris Stay-Silv-15
b. Handy & Harmon Sil-Fos.

PART 3 EXECUTION

3.01 PREPARATION

A. Measurements, Lines and Levels:
1. Check dimension at the building site and establish lines and levels for work specified in this Section.
2. Establish inverts, slopes, and manhole elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with Drawings and Specifications.
3. Use established grid and area lines for locating trenches in relation to building and boundaries.

3.02 EXCAVATION AND BACKFILL

A. General:
1. Perform necessary excavation and backfill required for the installation of mechanical work in accord with Division 02, Existing Conditions.
2. Repair pipelines or other work damaged during excavation and backfilling.

B. Excavation:
1. Excavate trenches to the necessary depth and width, removing rocks, roots, and stumps.
2. Include additional excavation to facilitate utility crossovers, additional offsets, etc.
3. Excavation material is unclassified. Width of trench adequate for proper installation of piping.
4. Widen trench if not wide enough for a proper installation.

C. Bedding:
1. Cast iron, steel, and copper piping full bedded on sand.
2. Place a minimum 4-inch deep layer on the leveled trench bottom for this purpose.
3. Remove the sand to the necessary depth for piping bells and couplings to maintain contact of the pipe on the sand for its entire length.
4. Lay other piping on a smooth level trench bottom so that contact is made for its entire length.

D. Backfill:
1. Place in layers not exceeding 8 inches deep, and compact to 95 percent of standard proctor maximum density at optimum moisture content.
2. Earth backfill free of rocks over 2 inches in diameter and foreign matter.
3. Disposal of excess material as directed.
4. Interior: Backfill under interior slabs bank sand or pea gravel.

5. Exterior:
    a. Excavated material may be used outside of buildings.
    b. First 4 inches sand and final 12-inch layer course soil in any event.

3.03 PIPING INSTALLATION

A. Install unions in non-flanged piping connections to apparatus and adjacent to screwed control valves, traps, and appurtenances requiring removal for servicing so located that piping may be disconnected without disturbing the general system.

B. Mechanical Pipe Couplings and Fittings:
    1. Grooved joint couplings, fittings, valves, and specialties products of a single manufacturer. Grooving tools of the same manufacturer as the grooved components.
    2. Flexible couplings to be used only when expansion, contraction, deflection or noise and vibration is to be dampened, as detailed or specified.
    3. On systems using galvanized pipe and fittings, fittings galvanized at factory.
    4. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with approved lubricant.
    5. Pipe grooving in accordance with manufacturer's specifications contained in latest published literature.
    6. Mold and produce gaskets by coupling manufacturer, and suitable for the intended service.
    7. Coupling manufacturer's factory trained representative to provide on-site training for the contractor's field personnel in the use of grooving tools and installation of grooved joint products. Periodically visit the project site to ensure best practices in grooved installation are being followed (a distributor's representative is not considered qualified to conduct the training or field visits).

C. Install piping as to vent and drain. Install according to manufacturer's recommendations.

D. Support piping independently at apparatus so that its weight not carried by the equipment.

E. Run piping clear of tube cleaning or removal/replacement access area on coils, heat exchangers, chillers, etc.

F. Dielectric Fittings: Provide dielectric couplings, unions, or flanges between dissimilar metals. In addition, provide dielectric couplings as required to isolate cathodically protected piping and equipment.

3.04 PIPING JOINTS

A. Pipe and Fittings:
    1. Join using methods and materials recommended by manufacturer in conformance with standard practice and applicable codes.
    2. Cleaning, cutting, reaming, grooving, etc. done with proper tools and equipment.
    3. Hacksaw pipe cutting prohibited.
    4. Peening of welds to stop leaks not permitted.

B. Purge refrigerant piping with nitrogen continuously during the piping installation, and seal each branch outlet with Visqueen and tape or similar method to assure continued cleanliness of interior of piping until system is completed.

C. Copper Piping:
    1. Pipe cut evenly with cutter, ream to full inside diameter; end of pipe and inside of fitting thoroughly cleaned and polished.
    2. Joints uniformly heated, and capillary space completely filled with solder or braze material, leaving full bead around entire circumference.

D. No couplings installed in floor or wall sleeves.

E. Steel Piping:
    1. Screwed Joints:
        a. Pipes cut evenly with pipe cutter reamed to full inside diameter with burrs and cuttings removed.

b. Joints made up with suitable lubricant or Teflon tape applied to male threads only, leaving two threads bare.
c. Tightened so that not more than two threads are left showing.
d. Junctions between galvanized steel waste pipe and bell of cast iron pipe made with tapped spigot or half coupling on steel pipe to form spigot end and caulked.

2. Flanged Joints:
a. Pressure rating of flanges to match valve or fitting joined.
b. Coat joint gaskets with graphite and oil.

F. Welded Joints:
1. Preparation for Welding: Bevel piping on both ends before welding:
a. Use following weld spacing on buttwelds:

Nominal Pipe Wall Thickness	Spacing	Bevel
1/4-inch or less	1/8-inch	37-1/2
Over 1/4-inch, less than 3/4-inch	3/16-inch	27-1/2

b. Before welding, remove corrosion products and foreign material from surfaces.
2. Welded Joints:
a. Arc weld joints using certified welders.
b. Port openings of fittings must match the inside diameter of the pipe to which they are welded.
c. Use full radius welding elbows for turns. Use welding tees for tees.
d. Reducing fittings must be used for size reduction.
e. Weldolets may be used for branches up through one-half the pipe size of the main to which they are attached.
f. Nipples are not allowed.
3. Welding Operation:
a. After deposition, clean each layer of weld metal to remove slag and scale by wire brushing or grinding. Chip where necessary to prepare for proper deposition of next layer.
b. Weld reinforcement no less than 1/16-inch not more than 1/8-inch above normal surface of jointed sections. Reinforcement crowned at center and taper on each side to surfaces being joined. Exposed surface of weld present professional appearance and be free of depressions below surface of jointed members.
c. Do not weld when temperature of base metal is lower than 0 degrees F. Material to be welded during freezing temperatures made warm and dry before welding is started. Metal warm to the hand or approximately 60 degrees F.

G. Screwed Joints: Use Teflon tape or Teflon liquid dope applied to male threads only.

H. Flexible Couplings: Provide where indicated on the Drawings.

I. PVC Piping:
1. Socket weld joints with solvent cement and application method recommended by manufacturer.
2. Use power saw and miter box to cut PVC pipe, except DI piping must be cut with a wheel cutter specifically made for plastics.
3. Allow proper curing time based on temperature range during cure period before pressure testing.

3.05 ADJUSTING AND CLEANING

A. General:
1. Clean interior of piping before installation.
2. Flush sediment out of piping systems after installation before connecting mechanical equipment to the piping.
3. Open control valves, balance valves and isolation valves except as needed to flush in stages to achieve 6-8 fps at all points. Check strainers, clean as needed, and continue flushing until strainers are clean.

4. When placing the water systems in service during construction, each system cleaned by circulating a solution with 1000 ppm of trisodium phosphate for 24 hours, then drained, flushed and placed in service.
5. Clean strainers prior to placing in service.

END OF SECTION

SECTION 23 2123

PUMPS FOR HVAC SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Base Mounted Centrifugal Pumps
   2. Condensate Pumps

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 QUALITY ASSURANCE

A. Select pump impellers such that impellers shall not be greater than minimum impeller size plus 90 percent of the difference between the maximum and minimum impeller size for pump selected.

B. Select motor to be non-overloading under all operating conditions.

C. Select pump with a minimum efficiency as listed in schedule.

D. Provide couplings and seals suitable for application (including temperature, pH, glycol solution concentration, and loads over full range of pump operation).

E. Pumps and motors with flexible couplers shall be factory aligned, and realigned by manufacturer's representative after installation.

1.04 SUBMITTALS

A. Submit the following:
   1. Product data for each pump including performance curves, pump efficiency, motor data, operating weights, and pressure ratings.
   2. Submit control information and wiring diagrams for packaged equipment.
   3. Operating and maintenance data for each product specified under this Section.
   4. Detailed shop drawings.
   5. Installation instructions.

PRODUCTS

1.05 MANUFACTURERS

A. Base Mounted Centrifugal Pumps:
   1. Paco
   2. Peerless
   3. Bell and Gossett
   4. Goulds
   5. Armstrong
   6. Taco
   7. Thrush
   8. Aurora
   9. Other Manufacturers: Submit Substitution Request.

B. Condensate Pumps:
   1. Little Giant
   2. Other Manufacturers: Submit substitution request.

1.06 BASE MOUNTED CENTRIFUGAL PUMPS

A. Description: End suction centrifugal pump, motor, flexible coupling drive mounted on a common steel baseplate.

B. Components:
   1. Vertical split case construction, cast iron volute, bronze fitted.
   2. 175 psig working pressure unless otherwise noted.
   3. Enclosed type, single stage, bronze impeller.
   4. Mechanical shaft seal, regreasable ball bearings.
   5. Motor: 1750 rmp maximum speed.
   6. Coupling drive and guard.
   7. Steel baseplate with open grouting area.
   8. Pump internals capable of being serviced without disturbing piping.
   9. Capacity head and power requirements as scheduled on Drawings.

1.07 CONDENSATE PUMPS

A. Description:
   1. Pump for removal of evaporator condensate complete with integral float switch, receiver, power cord, safety switch, and check valve.
   2. Factory piped, wired, assembled, and tested.
   3. Capacity, head, and power requirements as shown on Drawings.

B. Components:
   1. Integral Float Switch
   2. Receiver
   3. Power Cord
   4. Safety Switch
   5. Discharge Check Valve

PART 2 EXECUTION

2.01 BASE MOUNTED CENTRIFUGAL PUMP INSTALLATION

A. Install pump in location shown in accordance with manufacturer’s written installation instructions.

B. Install on inertia base.

C. Provide flexible connections, strainers, check valves and shutoff valves on suction, and discharge as shown on Drawings.

D. Lubricate in accordance with manufacturer’s instructions before operation.

E. Support interconnecting piping independently of pump and inertia base to prevent stresses from being transmitted to the casings.

2.02 CONDENSATE PUMP INSTALLATION

A. Install in accordance with manufacturer’s recommendations.

B. Install pump level and below the coil drain outlet.

C. Extend coil drain outlet to condensate pump receiver.

D. Connect to permanent power source.

END OF SECTION

SECTION 23 2500
HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Closed Loop Systems

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilation and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings
   2. Product Data
   3. Operating and Maintenance Data
   4. Certificate of Completion
   5. Treatment Reports

PART 2 PRODUCTS

2.01 MANUFACTURER

A. ChemAqua (Patrick Gibbs, Patrick.gibbs@chemaqua.com 541-797-6691).

2.02 CLOSED LOOP SYSTEMS

A. Chemicals: Will be provided by School District's chemical treatment provider. Chemical provider will be a sub to the mechanical contractor.

B. One Shot Feeder:
   1. Furnish and install one-shot chemical bypass feeders on each closed loop system where water treatment is specified.
   2. Construction:
      a. 2 quart, 4 quart, 10 quart, or maximum of 5 gallon volume as required to initially treat the system served in two shots.
      b. Pressure Rating: 150 psig or 300 psig to match other valve and pressure vessel ratings.
      c. Provide fill funnel and valve, air vent cock and drain valve and plug.

PART 3 EXECUTION

3.01 INSTALLATION

A. HVAC Closed Loop Systems:
   1. Install shot feeders across pump or appropriate restricting valve with adequate mounting to prevent piping damage and preclude transmitting vibration to structure.
   2. Filling may be through bypass shot feeder across pump.
   3. Final system treatment achieves 800-1200ppm Sodium Nitrite in the system water. Apply tolyltriazole levels of minimum 3ppm in closed loop water.
   4. Test to confirm proper inhibitor levels.
   5. Install glycol mixing tank according to manufacturer's recommendations to provide scheduled concentration of glycol.
   6. Install corrosion coupon rack per manufacturer's recommendations around the supply and return side of circulating pump. Install isolation valves at each side of rack within easy reach of operator.

3.02 FINAL ADJUSTMENT

A. When the systems are accepted by the Owner the chemical treatment supplier to make final adjustments in the required concentrations.

B. Submit report of indicating initials and final concentrations and system chemistry.

C. Furnish sufficient chemicals to constitute one years supply for systems.

END OF SECTION

SECTION 23 3101

HVAC DUCTS AND CASING-LOW PRESSURE

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Supports, Anchorage And Restraints
   2. Sheet Metal Ductwork
   3. Flexible Ducts
   4. Ductwork, Grease Hood Exhaust
   5. Exposed or Visible Ductwork In Finished Spaces
   6. Stainless Steel Ductwork
   7. Aluminum Ductwork

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 22 3000, Plumbing Equipment

D. Section 23 0548, Vibration and Seismic Controls for HVAC Piping Equipment

E. Section 23 0700, Insulation for HVAC

F. Section 23 3300, Air Duct Accessories

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Work performed by qualified, experienced mechanics, in accordance with the manual of Duct and Sheet Metal Construction of the Sheet Metal and Air Conditioning Contractors National Association and these Specifications.

B. Regulatory Requirements:
   1. Entire ductwork system, including materials and installation, installed in accordance with NFPA 90A.
   2. Ductwork and components UL 181 listed, Class I air duct, flame rating not to exceed 25 and smoke rating not to exceed 50.

1.04 SUBMITTALS

A. Submit the following:
   1. Provide catalog data on each product specified hereunder.
   2. Schedule of duct construction standards.
   3. Provide shop drawings showing materials and construction details for single wall housing plenum.
   4. Provide shop drawings showing construction details, support, and seismic restraint of ductwork distribution systems.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flexible Ducts:
   1. Thermaflex M-KE
   2. Gen Flex IMP-25S
   3. Other Manufacturers: Submit substitution request.

2.02 SUPPORTS, ANCHORAGE AND RESTRAINTS

A. General:
   1. Provide design for supports, anchorages, and seismic restraints for equipment when not shown on the Drawings.

2. Supports, anchorage and restraints provided are required to resist seismic forces as specified in the latest edition of the International Building Code for the seismic zone in which the project is constructed.
3. Follow provisions in Section 23 0548, Vibration and Seismic Control for HVAC Piping and Equipment for seismic restraints.
4. Seismic restraints are not to introduce stresses in the ductwork caused by thermal expansion or contraction.
5. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Suspended Ductwork: Provide seismic restraints in accordance with the latest edition of the SMACNA, Seismic Restraint Manual - Guidelines for Mechanical Systems for the seismic hazard level corresponding to the seismic zone in which the project is constructed.

C. Engineered Support Systems: Provide designs and details for the following support systems with the seal of a professional engineer registered in the State having jurisdiction:
1. Supports and seismic restraints for suspended ductwork and equipment.
2. Support frames for ductwork and equipment which provide support from below.
3. Equipment and ductwork support frame anchorage to supporting slab or structure.

2.03 SHEETMETAL DUCTWORK

A. Fabricate from galvanized steel, unless noted otherwise.

B. Minimum gauge, duct construction, joint reinforcing, fittings, hangers, and supports in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, Latest Edition.

C. Duct Classification: Ducts considered low pressure when design velocities are 2000 fpm or less and maximum static pressure is 2-inches wg positive or negative.
1. The following ductwork constructed in accordance with minimum reinforcement requirements for static pressure class of 1/2-inch wg positive or negative.
   a. Supply ductwork downstream from terminal units.
   b. Supply, return or exhaust ductwork serving fans scheduled to operate at less than 1/2-inch wg
   c. Supply, return, or exhaust branch ductwork which serves one or two inlets/outlets.
2. The following ductwork constructed in accordance with minimum reinforcement requirements for static pressure class of 1-inch wg positive or negative.
   a. Supply, return, or exhaust ductwork serving fans scheduled to operate at less than 1-inch wg On supply fans pressure drops for louvers, coils, clean filters, and sound traps may be deleted from scheduled fan static.
   b. Supply, return, or exhaust ductwork serving multiple duct branches where contractor can demonstrate that pressures will not exceed 1-inch wg positive or negative.
   c. Boiler direct vent combustion air intake ductwork.
   d. Water heater direct vent combustion air intake ductwork.
3. The following ductwork constructed in accordance with minimum reinforcement requirements for static pressure class of 2-inches wg, positive or negative.
   a. Supply, return, or exhaust ductwork serving fans scheduled to operate at pressures greater than 1-inch wg positive or negative.

D. Longitudinal seams on rectangular duct, Pittsburgh or Button punch snap lock. Snap lock seams for round duct may be used only on ducts classified for 1/2-inch wg. Longitudinal seams for round ducts using lap and rivet, spot weld, or fillet weld may be used only on ducts classified for statics 1-inch wg or less.

E. Joining and reinforcing systems manufactured by Ductmate, Roloc, or TDC are acceptable. Ductmate 35 is equivalent to SMACNA J, and Ductmate 25 is equivalent to SMACNA F.

F. Use of adjustable round elbows not permitted.

2.04 FLEXIBLE DUCTS

A. Flexible air duct with CPE or metal film liner permanently bonded to coated spring steel wire helix with 1-inch thick fiberglass insulation blanket covered with fiberglass reinforced metal film vapor barrier jacket.

B. Duct rated for 6-inch wg positive and 1-inch wg negative.

2.05 DUCTWORK, GREASE HOOD EXHAUST

A. Materials: Stainless steel, minimum 18 gauge.

B. Fabrication: Make joints and seams with a continuous grease tight weld on the external surface of the duct system.

C. Fittings: Elbows the radius type with centerline radius equal to or greater than 1-1/2 times the depth of the duct in the plan of the turn.

D. Construct and install ductwork so that grease cannot accumulate.

E. Access Doors: 16 gauge minimum steel with gaskets and latches easily operable without the use of a tool.

2.06 EXPOSED OR VISIBLE DUCTWORK IN FINISHED SPACES

A. Round:
   1. Material:
      a. Round or flat oval, machine formed, spiral lock-seam galvanized sheet metal ductwork of thicknesses as listed for sheet metal duct.
      b. Paintable surface.
   2. Fittings: Machine formed, shop fabricated, with welded seams, designed for easiest air flow, similar to United Sheet Metal numbers listed.
      a. Mitered Elbow with Turning Vanes: Type EV-90-2.
      b. Radius Elbows: Type E090-5. Similar for less than 90 degree elbows.
      c. Tees: Type Con-T-1.
      d. Reducing Fittings: May be used unless noted otherwise.

B. Rectangular:
   1. Same as for sheet metal ductwork but paintable surface.
   2. Inside reinforcing.
   3. Use special care to prevent imperfections in the metal surface.

2.07 STAINLESS STEEL DUCTWORK

A. Ductwork listed below and ductwork indicated on drawings constructed of 18 gauge minimum stainless steel with 2D finish concealed and No. 4 finish exposed. Type 304 or 316 as indicated.

B. Seams: Welded and liquid tight.

C. Accessories:
   1. Stainless steel including dampers
   2. Damper Hardware
   3. Turning Vanes

2.08 ALUMINUM DUCTWORK

A. Ductwork listed below and ductwork indicated on drawings constructed of 3003-H-14 alloy aluminum. Gauge of metal and construction details to be determined by using minimum equivalent thickness and reinforcing for galvanized steel tables in SMACNA.

B. Longitudinal seams, Pittsburgh type.

C. Button punch snap lock seams not allowed.

PART 3 EXECUTION

3.01 APPLIED LOCATIONS

A. Supply ductwork on downstream side of terminal box. Galvanized sheet metal ductwork, lined where indicated on the Drawings or as specified in Section 23 0700, Insulation for HVAC.

B. Supply Ductwork from Spin-In Fittings to Supply Outlet Collar Connection: Flexible duct, maximum 4-foot length.

C. Return Air Trunk Ductwork from End Run to Unit Connection: Galvanized sheet metal ductwork, lined where indicated on the Drawings or as specified in Section 23 0700, Insulation for HVAC.

D. Exhaust Ductwork: Galvanized sheet metal ductwork, lined where indicated on the Drawings or as specified in Section 23 0700, Insulation for HVAC.

E. Ductwork between Transfer Grilles: Galvanized sheet metal ductwork, lined where indicated on the Drawings or as specified in Section 23 0700, Insulation for HVAC.

F. Exposed or Visible Ductwork in Finished Spaces: Sheet metal as specified for application, lined where indicated on the Drawings or as specified in Section 23 0700, Insulation for HVAC.

G. Combustion Air Ductwork for Boilers: Galvanized sheet metal ductwork.

H. Stainless Steel Ducts:
   1. Type 304:
      a. Kitchen grease and dishwasher exhaust.,

I. Aluminum ducts:
   1. Moisture laden air exhaust branch ducts up to the point of connection to the main exhaust system.

3.02 INSTALLATION

A. Ductwork:
   1. Seal traverse joints with an approved mastic during joining procedure or tape after joining to provide airtight duct system.
   2. Low pressure ductwork hanger and support systems in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible. Wire supports are not allowed.
   3. Provide supplementary steel for support of ductwork in shafts and between building structural members.
   4. Fabricate changes in direction to permit easy air flow, using full 1.5D radius bends or fixed turning vanes in square elbows. Radius elbows less than 1.5D radius, splitter vanes.
   5. Change in duct size or shape necessitated by interference made using rectangular equivalents of equal velocity.
   6. Where pipe, structural member, or other obstruction passes through a duct, provide streamlined sheet metal collar around member and increase duct size to maintain net free area. Fit collar and caulk to make air tight.

B. Sound Attenuation (Internal Insulation):
   1. Provide sound attenuation duct where shown and as specified under Section 23 0700, Insulation for HVAC.
   2. Duct dimensions shown are net inside attenuating material.

C. Dampers: Install where shown and where necessary to complete final balancing of system. Install regulators as specified in Section 23 3300, Air Duct Accessories for each specific project condition. Leave dampers locked wide open in preparation for balancing.

D. Flexible Connectors: Make connections to fans and other rotating equipment with flexible connectors with 2-inch minimum clearance between casing and ductwork. Not required on internally spring isolated units.

E. Flexible Ducts:
   1. Make connections at ends using draw band strap and a minimum of 2 wraps of duct tape.

2. Suspend center spans from structure above using wire as required by code. Connect to manufacturer's eyelet on jacket or use 1-inch wide galvanized steel strap with single loop at top and smooth edges.
3. Suspending duct by laying it on the ceiling is prohibited.
4. Avoid crimping flex duct. Changes in direction made using 2D radius. Duct connections to grilles, registers, and diffusers using less than 2D radius bends are not acceptable. Where space is constricted, use sheet metal elbows or Thermaflex Flex Boots (or equal).

F. Ductwork, Grease Hood Exhaust:
1. Slope minimum of 1/4-inch per foot of run toward the hood. Where horizontal ducts exceed 75-feet in length, slope minimum of 1-inch per foot of run.
2. Install access doors at every change in direction and maximum of 10-feet on center.
3. Provide access doors and allow penetrations for sprinklers as required by Fire Protection section of these specifications.
4. Install ductwork in a rated shaft as specified under other divisions of work.

G. Ductwork, Exposed or Visible in Finished Areas:
1. Use extreme care in handling and installing.
2. Replace dented or damaged sections.
3. Install ductwork straight and true, parallel to building lines.
4. Make connections with pop rivets using couplings where applicable. Grind raw edges smooth and apply paintable sealant to cover imperfections.
5. Remove excess sealant to provide a finished joint.
6. Provide floor, wall, and ceiling plates as specified in Section 23 0500, Common Work Results for HVAC.
7. Finish, clean and prime ductwork, and hangers for painting.

H. Stainless Steel Duct: Install stainless steel ductwork similar to galvanized ductwork per SMACNA standards.

I. Aluminum Duct:
1. Slope minimum of 1/4-inch per foot of run toward the grille.
2. Install similar to galvanized duct work per SMACNA standards.
3. Provide dielectric protection when joining aluminum duct to steel duct by utilizing neoprene flexible connections or other approved method.
4. Use aluminum straps and hangers to support aluminum, ductwork.

3.03 FIELD QUALITY CONTROL

A. Coordination with Balance Agency:
1. Provide services of a sheet metal person familiar with the system ductwork to provide assistance to the balancing agency during the initial phases of air balancing in locating sheet metal dampers.
2. Install missing dampers required to complete final balancing.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Low Pressure Duct Accessories
   2. Fire and Smoke Dampers

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 3101, HVAC Ducts and Casing-Low Pressure

D. Section 23 3102, HVAC Ducts and Casing-Medium Pressure

E. Section 23 0900, Instrumentation and Controls for HVAC

1.03 QUALITY ASSURANCE

A. Work performed by qualified, experienced mechanics in accordance with the manual of Duct and Sheet Metal Construction of the National Association of Sheet Metal and Air Conditioning Contractors and these Specifications.

B. Install entire ductwork system, including materials and installation, in accordance with NFPA 90A.

C. Flexible connectors, flexible equipment connections, tapes, and sealants listed as UL 181, Class I air duct. Flame spread rating not to exceed 25 and smoke developed rating not to exceed 50.

1.04 SUBMITTALS

A. Submit the following: Product data for Duct Accessories.
   1. Low Pressure Duct Accessories:
      a. Access Doors
      b. Backdraft Dampers
      c. Water Eliminators
      d. Dryer Vent
      e. Roof Jack
      f. Automatic Dampers
   2. Fire and Smoke Dampers:
      a. Fire Dampers
      b. Combination Smoke and Fire Dampers

B. Operation and Maintenance Data: Automatic dampers, fire dampers, smoke dampers. Combination smoke and fire dampers, air flow station.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Low Pressure Duct Accessories:
   1. Flexible Equipment Connector:
      a. Duro Dyne Corporation
      b. Ventfabrics
   2. Extrators:
      a. Carnes
      b. Anemostat
      c. Barber-Coleman
      d. Nailor-Hart
      e. Or approved equal.

3. Access Doors:
    a. Air Balance
    b. Ruskin
    c. Metco
    d. Duro Dyne Corporation
    e. Cesco
    f. Nailor-Hart
    g. Or approved equal.
4. Backdraft Dampers:
    a. Air Balance
    b. Ruskin
    c. Cesco
    d. Advanced Air
    e. Nailor-Hart
    f. Greenheck
    g. Or approved equal.

B. Fire and Smoke Dampers:
    1. Where Ruskin is the only manufacturer indicated, equivalent products may be furnished.

2.02 LOW PRESSURE DUCT ACCESSORIES

A. Damper Regulators:
    1. Acceptable Manufacturers:
        a. Ventlok
        b. Young
        c. Duro Dyne Corporation
        d. Greenheck
        e. Or approved equal.
    2. Dial Regulator – Concealed or exposed duct in unfinished spaces:
        a. Blade lengths 18-inch and less: 3/8-inch shaft
        b. Blade lengths 19-inches and above: 1/2-inch shafts
        c. Ventlok 635, or 638 for insulated duct
    3. Dial Regulator – Exposed duct in finished space:
        a. 3/8-inch shaft
        b. Ventlok 640
    4. Dial Regulator – Concealed or non-accessible duct:
        a. Blade lengths 18-inch and less: 3/8-inch shaft
        b. Blade lengths 19-inches and above: 1/2-inch shafts
        c. Ventlok 666 regulator with 680 mitered gear assembly where right angled turn is necessary.
        d. Ceiling concealed regulator: 7/8” Threaded Ceiling Cap with tamper proof screw, Young Regulator 270-896.
        e. Wall mounted regulator: Junction box with stainless steel cover plate and wall knob, Young Regulator 270-700.
        f. Diffuser mounted regulator: Remote cable plenum assembly, Young Regulator 270-275.
    5. End Bearings:
        a. Ducts rated to 1-inch WG, open end, Ventlok 607.
        b. Ducts rated above 1-inch WG, closed end, Ventlok 609.
        c. Exposed ductwork, finished spaces, Ventlock 609.
        d. Spring end bearings not allowed.

B. Flexible Equipment Connector:
    1. Description: Woven fiberglass fabric with neoprene coating, air-tight, water-tight, fire retardant.
    2. Minimum Density: 30 oz. per sq. yd.

3. Temperature Range: -20 degrees F to 200 degrees F
4. Pressure Range: -10-inch wg to +10-inch wg
5. Extractors (EX): Gang operated blades, steel construction, blades at 1-inch centers, slide operator set 15 degrees into main trunk duct, Titus AG-45 with No. 1 operator.

C. Duct Sealer:
1. Based On:
   a. McGill Airseal Zero
   b. Design Polymerics DP 1090
2. Description:
   a. Suitable for indoor/outdoor use, including application in moist conditions, rated to 10-inch wg.
   b. Maximum Flame Spread/Smoke Developed Rating of 25/50, maximum VOC of 420 g/L less water.
   c. SCAQMD Rule 1168 compliant.

D. Duct Tape for Sheet Metal:
1. ARNO C520 duct tape similar United
2. Duro Dyne Corporation
3. Nashua

E. Tape and Adhesive/Activator System for Sheet Metal: Hardcast, Polymer Adhesives.

F. Turning Vane Assemblies:
1. Sheet Metal Vanes: Multiple radius hollow vane air foil type 2-inch (small vane) or 4-1/2-inch (large vane) inside radius, galvanized steel construction.
2. Runners: Push-on type.
3. Acoustical Vanes: Multiple radius air foil type, perforated steel construction with fiberglass fill. AirSan Acoustiturn or as approved.

G. Access Doors:
1. Doors complete with steel frame, steel door with backing plate, cam latches (two on units 14-inch by 14-inch and larger), hinge, and gasketing. Insulate doors on insulated or lined ducts.
2. Grease Duct Access Door: Construct of metal thickness equal to metal duct, doors air, and grease tight with hinge and hand operable latches. Ductmate.
3. Size:

Duct Width or Duct Diameter	Net Access Door Opening
Up to 8-inch	6-inch by 6-inch
9-inch to 12-inch	8-inch by 8-inch
13-inch to 20-inch	12-inch by 12-inch
21-inch to 30-inch	16-inch by 14-inch
31-inch to 42-inch	18-inch by 14-inch
Over 42-inch	Two 16-inch by 14-inch

H. Backdraft Dampers:
1. Description: Gravity operated, counter-weighted, metal bladed backdraft dampers.
2. Performance: Less than 0.01” wc pressure drop required to open damper.
3. Manufacturer: Ruskin CBD2 or approved

I. Drip Pans: Provide Type 304 stainless steel drip pans for cooling coils.

J. Dryer Vent:
1. Galvanized or anodized aluminum alloy hood with hinged backdraft damper.
2. Birdscreen not permitted.
3. Provide roof curb coordinated with insulation thickness for rooftop applications.
4. Roof mount: DryerJack DJK486U w/ integral curb cap or approved equal.
5. Wall mount: Seiho SFB-P or approved equal.

K. Roof Jack:
   1. Enamel finish steel with back draft damper and bird screen.
   2. Broan 636 or approved equal.

L. Automatic Dampers:
   1. Description:
      a. Multi-blade air foil type, except where either dimension is less than 10-inches a single blade may be used. Maximum blade length to be 48-inches.
      b. Provide parallel blades for positive or modulating mixing service and opposed blades for throttling service.
      c. Blades to be interlocking, minimum 16 gauge galvanized steel.
   2. Compression type edge seals and side seating stops.
   3. Reinforced blades, have continuous full length axle shafts, axle to axle linkage, and/or operating jackshafts to provide coordinated tracking of blades.
   4. Dampers over 25 square-feet in area to be in two or more sections, with interconnected blades. Maximum air leakage of 3 cfm per square foot at 1-inch wg pressure.
   5. Provide automatic dampers except those specified to be provided with units. Tested in accordance with AMCA Standard 500. Based on Ruskin CD-60.
   6. Damper Operators: Refer to Section 23 0900, Instrumentation and Controls for HVAC.
   7. Manufacturers:
      a. Ruskin
      b. Greenheck
      c. Air Balance
      d. Cesco
      e. Or approved equal.

2.03 FIRE AND SMOKE DAMPERS

A. Static Fire Dampers:
   1. Code Compliance: Provide static fire dampers with a UL 555 label for fire rating indicated and in conformance with NFPA 90A.
   2. Integrally hinged, folding blade curtain type, for installation in ductwork complete with 160 degrees F fire link and retainer.
   3. Suitable for horizontal or vertical installation as required. Furnish stainless steel closure springs and cam lock for complete damper closure on dampers to be installed in vertical air flow positions.
   4. Medium pressure, 1-1/2-hour: For use in partitions up to 2-hour rating with damper out of air stream. Ruskin Model IBD2, Style C for rectangular, Style CR for round, style CO for oval.
   5. Medium pressure, 3-hour: For use in partitions over 2-hour rating with damper out of air stream. Ruskin Model IBD23, Style C for rectangular, Style CR for round, Style CO for oval.
   6. Low pressure, 1-1/2-hour: For use in partitions up to 2-hour rating with damper out of air stream for supply.
      a. Ruskin Model IBD2 Style B for supply.
      b. Ruskin Model IBD2 Style A for return or exhaust.
   7. Low pressure, 3-hour: For use in partitions over 2-hour rating with damper out of air stream for supply.
      a. Ruskin Model IBD23 Style B for supply.
      b. Ruskin Model IBD23 Style A for return or exhaust.
   8. Transfer grilles, 1-1/2-hour: 7/8-inch deep for use in partitions up to 2-hour rating. Ruskin Model IBDT Thinline.
   9. Ceiling fire dampers with 20 gauge galvanized steel blades, 212 degrees F fusible link, UL listed, Ruskin CFD (R) 2 or CFD (2) 3. Provide thermal blanket.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install devices as shown on the Contract Drawings and per manufacturer's recommendations.

B. Low Pressure Duct Accessory installation specified under Section 23 3101, HVAC Ducts and Casing-Low Pressure.

C. Fire Dampers:
   1. Install dampers in accordance with NFPA 90A and manufacturer's written recommendations.
   2. Size and locate dampers as shown on Drawings.
   3. Install dynamic fire dampers in correct position with regards to direction of air.
   4. Where dampers are not accessible for servicing by removing an outlet, provide access doors for servicing. Doors compatible with the duct in which they are installed.

D. Access Doors: Install where indicated and at automatic control dampers, backdraft dampers and fire dampers to provide access for cleaning and maintenance.

E. Kitchen Grease Duct Access Doors: Install every 10-feet and at each change in direction of kitchen exhaust duct per code.

F. Back Draft Dampers: Install where indicated and at the discharge (or inlet) of exhaust fans where automatic dampers are not indicated.

G. Automatic Dampers:
   1. Install where indicated.
   2. Coordinate damper operators with Section 23 0900, Controls.

H. Drip Pans:
   1. Install under each cooling coil and exhaust heat recovery coil as indicated.
   2. Provide drain connection from each drip pan and pipe to nearest floor drain through trap.
   3. Drip pans over 6-feet in length require drain connections from both ends.
   4. Pitch drip pans in direction of air flow and to drain.

END OF SECTION

SECTION 23 3319

DUCT SILENCERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Duct Silencers

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 3101, HVAC Ducts and Casing-Low Pressure]

D. Section 23 3102, HVAC Ducts and Casing-Medium Pressure

E. Section 23 3300, Air Duct Accessories

1.03 QUALITY ASSURANCE

A. Silencer performance characteristics, including insertion loss, pressure drop, and generated noise, attained through testing in accordance with the latest ASTM E477 test standard for acoustical duct silencers.

B. Performance Data:
   1. Obtain from the manufacturer's NVLAP accredited laboratory.
   2. Laboratory performance verification in the manufacturer's test facility may be requested, in which case a comparative test report made available to the engineer.

C. Combustion ratings for acoustic media equal to or less than the combustion ratings noted below when tested in accordance with ASTM E84 or UL723:
   1. Flame Spread Classification: < 25
   2. Smoke Development Rating: < 50

D. Silencers factory fabricated and supplied by the same manufacturer.

E. Construct silencers in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed.

1.04 SUBMITTALS

A. Submit the following:
   1. Manufacturer's performance data for dynamic insertion loss, generated noise, and pressure drop provided and obtained in accordance with ASTM E477.
   2. Schedule of data for each silencer with the size, configuration, airflow rate, and airflow direction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Duct Silencers
   1. Price
   2. Vibro-Acoustics
   3. Ruskin
   4. Dynasonics
   5. Commercial Acoustics
   6. Semco
   7. Other Manufacturers: Submit substitution request.

2.02 DUCT SILENCERS

A. Pressure rated airtight at 6-inch wg differential between inside and outside of silencer.

B. Acoustical Fill Material:
   1. Inorganic Glass Fiber:
      a. Not less than 4 pcf density.
      b. Not less than 10 percent compression.
      c. Inert, vermin resistant, and moisture resistant.
      d. Silencers with Internal Velocities that exceed 4000 fpm: Add fiberglass cloth to the silencer between the internal perforated liner and the acoustic media to protect the media from erosion.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in ducts per manufacturer's recommendations.

B. Seal space between each module with nosing strips and duct sealer to prevent air from passing between modules.

C. Where attenuators are installed directly on concrete, provide 30 roofing felt or 1-inch roofing insulation under attenuators. Not required when attenuators do not come in contact with concrete.

END OF SECTION

SECTION 23 3400

HVAC FANS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Centrifugal Fans
   2. Roof Exhaust Fans
   3. Roof Ventilators
   4. Inline Centrifugal Fans
   5. Dryer Booster Fan
   6. Air Curtains

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings: Showing dimensions, details of construction.
   2. Product Data: Showing performance of fans.
   3. Operation and Maintenance Data
   4. Submit certified sound power ratings for each fan.
   5. Special Seismic Certification in accordance with ASCE/SEI 7 Chapter 13. Refer to 23 0548.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Centrifugal Fans:
   1. Penn-Barry
   2. Twin City
   3. Greenheck
   4. Cook
   5. Other Manufacturers: Submit substitution request.

B. Roof Exhaust Fans:
   1. Carnes
   2. Penn-Barry
   3. Greenheck
   4. Cook
   5. Acme
   6. Twin City
   7. Other Manufacturers: Submit substitution request.

C. Roof Ventilators:
   1. Greenheck
   2. Penn-Barry
   3. Cook
   4. Twin City
   5. Other Manufacturers: Submit substitution request.

D. Inline Centrifugal Fans:
   1. Greenheck
   2. Penn-Barry
   3. Cook
   4. Twin City
   5. Other Manufacturers: Submit substitution request.

E. Dryer Booster Fan:
   1. Fantech
   2. Other Manufacturers: Submit substitution request.

F. Air Curtains
   1. Powered Aire
   2. Berner
   3. Mars
   4. Other Manufacturers: Submit substitution request.

2.02 CENTRIFUGAL FANS

A. Description: Centrifugal or utility type centrifugal fans as indicated, standard factory finish, AMCA rated.

B. Fans:
   1. Single width, single inlet, double width, double inlet, forward curved, backward inclined, or air foil blades as scheduled.
   2. Welded steel housing with sloped cut-off plates, spun steel, or die formed inlet cone, welded steel supports.
   3. Statically and dynamically balanced in the factory as an assembly within its own bearings with a maximum full amplitude shaft deflection at bearings not to exceed 0.001-inch at 1200 RPM to meet ANSI S 2.19 G2.5 balance quality grade.
   4. Grease packed pillow block sealed bearings with not less than two pillow blocks per fan assembly. L-10 bearing life of 80,000 hours minimum per AFBMA Standards.

C. Motor:
   1. Integrally mounted, 1800 rpm maximum, with pre-lubricated sealed ball bearings.
   2. Refer to Section 23 0500 for energy efficient motor requirements.
   3. EC motors where scheduled. Standard motor controlled by VFD.

D. Direct Drive: Direct drive matched to fan loads.

E. Provide vibration isolation as indicated on drawings and in accordance with Section 23 0548, Vibration and Seismic Controls for HVAC Piping and Equipment.

F. Fans exposed to weather have heavy gauge protective covers over bearings and shaft assembly.

G. Fan outlets with removable angles and bolts for attaching flexible connections or discharge dampers.

H. Provide fans as indicated with protective coating on fan wheel and interior of fan housing. Apply coating before balancing fans and repair breaks in coating which occur during balancing. Coating one 6 mil coat of white plasite 7122 and one 6 mil coat of black plasite 7122.

2.03 ROOF EXHAUST FANS

A. General Description: Provide curb mounted centrifugal roof exhauster.

B. Fans:
   1. Single width, single inlet, airfoil blades as indicated.
   2. One piece heavy gauge spun aluminum construction, steel inlet bell, arranged for curb mounting.
   3. Kitchen grease exhaust fans up blast vertical discharge type, with NFPA restaurant installation curb. Units designed for use in kitchen hood applications with motor located outside the air stream. Provide non-sparking wheel assembly and scroll drain.
   4. Statically and dynamically balanced in the factory as an assembly within its own bearings with a maximum full amplitude shaft deflection at bearings not to exceed 0.003-inch at 1200 RPM to meet ANSI S 2.19 G6.3 balance quality grade.
   5. Grease packed pillow block sealed bearings with not less than two pillow blocks per fan assembly.

C. Motor:
   1. Integrally mounted, 1800 rpm maximum, with pre-lubricated sealed ball bearings.
   2. Provide two speed motors where indicated.
   3. Refer to Section 23 0500, Common Work Results for HVAC for energy efficient motor requirements.

D. Drive: Direct drive matched to fan loads.

E. Fan wheel and motor mounted on integral double deflection neoprene isolators.

F. Accessories:
   1. Bird screen
   2. Disconnect Switch under Enclosure
   3. Vented Roof Curb Extension for Kitchen Exhaust Application
   4. Vented Roof Curb for Kitchen Exhaust Application
   5. Roof Curb

G. Account for roof slope to provide level mounting service for equipment.

H. Curb height accounts for roof insulation depth and flashing requirements.

I. Provide automatic motorized control damper, aluminum blades with felt edges.

2.04 ROOF VENTILATOR

A. General Description:
   1. Heavy gauge aluminum, low silhouette, roll formed rib sections, standard finish, five-inch base, premanufactured curb, with bird screen.
   2. Account for roof slope to provide level mounting service for equipment.

2.05 INLINE CENTRIFUGAL FANS

1. General Description: Inline centrifugal, belt driven, cabinet fan, AMCA rated, backward inclined wheel, heavy gauge steel housing adequately braced with edges sealed, externally mounted 1800 rpm motor, hinged access doors.
2. Refer to Section 23 0500, Common Work Results for HVAC for energy efficient motor requirements.

B. Smoke Control Fans:
   1. Provide UL listing as “Power Ventilators for Smoke Control Systems” where used as a smoke control fan.

C. Direct Drive: Direct drive matched to fan loads.

D. Vibration Isolation: Provide vibration isolation as indicated on drawings and in accordance with Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

2.06 DRYER BOOSTER FAN

A. General Description: Inline centrifugal, direct drive, statically and dynamically balanced backward inclined wheel, heavy gauge galvanized steel housing.

B. Motor: Motorized impeller, external rotor type, Class B insulation, totally enclosed permanent split capacitor, permanently sealed self-lubricating ball bearings, automatic reset thermal overload protection, rated for continuous duty.

C. Switch: Positive pressure sensing switch mounted on the fan and pre-wired to activate at 0.05-inch wg static pressure.

2.07 AIR CURTAINS

A. General Description: Wall-mount fan unit to provide environmental separation at door openings, preventing heat loss from air infiltration.

B. Construction: Steel with black powder coat finish;

C. Dimensions: Width to suit 36-inch door; low profile, maximum 8-1/2-inch height.

D. Mounting: Wall

E. Motor: Single phase, variable speed, ODP, direct driven, resilient mounted.

F. Fan: Forward curved cross flow tangential type, aluminum construction.

G. Discharge Nozzles: Two inch slot by width of air curtain.

H. Vanes: 0.875 inch minimum height, airfoil shape, aluminum extrusions

I. Inlet: front, with cleanable aluminum filter

J. Heating: None (or as indicated on drawings)

K. Controls: Automatic magnetic door switch, integral safety disconnect switch.

L. Accessories: Wall brackets bully concealed behind unit.

M. Certifications: IECC compliant for vestibule alternative: minimum 400 ft/min air velocity at floor, tested in accordance with ANSI/AMCA 220.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Provide flexible connections on inlet and discharge duct connection. Flexible connection for vane axial fans to be barium loaded vinyl.

3.02 CENTRIFUGAL FANS

A. Suspend from structure with isolating hanger rods or mount on isolator base.

B. Extend scroll drain to over floor drain with pipe size the same as outlet size.

C. Lubricate bearings as recommended by the bearing manufacturer.

D. Startup: After installation and before starting:
   1. Check fan isolation for freedom of motion.
   2. Perform pre-startup tasks as recommended by the manufacturer.

3.03 ROOF EXHAUST FANS

A. Mount fan on roof curb in accordance with the manufacturer’s recommendations. Anchor fan to curb and curb to roof. Coordinate roof opening size and curb location.

B. Connect ductwork.

3.04 ROOF VENTILATOR

A. Mount roof vent on roof curb in accordance with the manufacturer's recommendations. Anchor roof vent to curb and curb to roof. Coordinate roof opening size and curb location.

B. Make ductwork connections.

3.05 INLINE CENTRIFUGAL FAN

A. Mount in ductwork using Vibration Isolation as specified in Section 23 0548 Vibration and Seismic Controls for HVAC Piping and Equipment, and as indicated on drawings.

B. Connect ductwork using flexible connections.

C. Arrange for unobstructed access to access door.

3.06 DRYER BOOSTER FAN

A. Mount in ductwork using vibration isolation clamps.

B. When fan is located within 15-feet of dryer connection provide secondary lint trap upstream of fan.

END OF SECTION

SECTION 23 3600
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Single Duct Terminal Units

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0700, Insulation for HVAC

D. Section 23 0900, Controls

1.03 QUALITY ASSURANCE

A. Select units for sound levels, maximum pressure drops, and maximum inlet velocity as specified.

1.04 SUBMITTALS

A. Submit the following:
   1. Catalog data, construction details, and performance characteristics for each type and size of terminal unit.
   2. Data showing compliance with discharge and radiated sound power level specified.
   3. Provide computer calculations for heating coils supplied with unit.
   4. Schedule of each air terminal unit including data scheduled on drawings.
   5. Operating and maintenance data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Single Duct Terminal Units:
   1. Nailor
   2. Other Manufacturers: Submit substitution request.

2.02 SINGLE DUCT TERMINAL UNITS

A. Description: Single duct, medium velocity, pressure independent, variable volume.

B. Construction:
   1. Casing:
      a. Minimum 22 gauge galvanized steel.
      b. Joints sealed and access doors gasketed, rectangular discharge with slip and drive connection.
      c. Leakage rate to be maximum of 15 cfm at 3.0-inch differential SP.
      d. Provide access door for cleaning of coil as an integral part of the unit.
   2. Internal Lining:
      a. General Applications:
         1) Coated dual density or matt faced insulation meeting NFPA 90A flame spread/smoke development rating of 25/50 or less and manufactured in accordance with UL 181.
         2) Liner not to contain Pentabrominated diphenyl ether or Octabrominated diphenyl ether.

C. Volume Regulator Assembly (DDC Controls):
   1. Controller and actuator provided by Section 23 0900, Instrumentation and Controls for HVAC, [factory mounted] [field mounted] in NEMA 1 enclosure.
   2. Multi-point averaging flow sensor with taps for balancing.

3. 16 gauge corrosion-resistant single or opposed blade damper with extruded PVC seals or peripheral gasket with tight close-off. Leakage past closed damper not to exceed 2 percent of the nominal catalog rating at 3-inch wg inlet pressure. Solid steel shaft.
4. Air valves metal construction, non-corrosive, with bearings self-lubricating and moving parts replaceable in the field.
5. Assembled unit tested, factory preset, and guaranteed to provide ±5 percent total maximum airflow rate through an inlet pressure range of 0.5-inches to 3-inches water.]

D. Air static pressure drop across terminal unit not to exceed 0.35-inch wg without coil and 0.6-inch wg with water coil. Maximum inlet duct velocities not to exceed 2200 fpm.

E. Sound Ratings: Tested as power level 10W to -12W in accordance with AHRI 880 standard and ASHRAE Standard 130 at 1-1/2 wg inlet static pressure. Unit discharge airborne and casing radiated sound not to exceed following rated sound power levels:

MAXIMUM AIRBORNE SOUND POWER (dB)							
CFM	OCTAVE BAND AND CENTER FREQUENCY (Hz)						
	63	125	250	500	1K	2K	4K
0 - 300	--	63	64	60	60	60	52
301 – 400	68	65	65	63	60	60	52
401 – 800	71	68	67	67	60	60	52
801 – 1200	73	72	68	67	60	60	52
1201 – 2000	73	75	69	67	60	60	54
2001 and above	--	80	78	76	67	67	60
* Units must have 5-feet of 2-inch thick lined duct or 3-feet 0-inch IAC MS sound trap provided with unit at units discharge to meet acoustic design goals							

MAXIMUM RADIATED SOUND POWER (dB)							
CFM	OCTAVE BAND AND CENTER FREQUENCY (Hz)						
	1	2	3	4	5	6	7
	63	125	250	500	1K	2K	4K
0-2000	71	68	61	61	55	55	50
2001 and above*							
* Units must have loaded vinyl wrap over 2-inch thick insulation							

F. Water Heating Coils:
1. Capacity as scheduled.
2. Supplied and installed by the terminal unit manufacturer.
3. Fin Thickness: 0.0045-inch minimum.
4. Tube Wall Thickness: 0.016-inch minimum.
5. Fin Spacing: 10 fins per-inch maximum.

PART 3 EXECUTION

3.01 INSTALLATION, TERMINAL UNITS

A. Support terminal units from structure using thread rod and brackets provided. Provide vibration isolation as indicated on plans, and as specified. Make a rigid duct connection to the inlet with minimum length of straight duct upstream of unit as recommended by the manufacturer or as noted whichever is greater.

B. Refer to Section 23 0700, Insulation for HVAC for duct lining requirements at outlet of terminal units.

C. Maintain 3-feet clear in front of control enclosure.

D. Arrange units for operation with control system. Coordinate with the work specified in Section 23 0900, Instrumentation for Controls for HVAC

E. Provide a minimum of 5-feet of ductwork prior to first spin-in fitting or outlet branch duct takeoff.

F. Install terminal unit to allow for complete access to controls, and items requiring maintenance or adjustment. When electrical disconnect is used, coordinate required clearance with NEC requirements, 36-inches minimum. In other cases maintain a minimum of 30-inches clearance directly in front of the controls.

G. Mount terminal unit controller, actuator to primary air valve, coil connections, control valve, and piping specialties on the same side of the terminal unit.

H. Install filters prior to operating equipment. Replace filters after substantial completion.

END OF SECTION

SECTION 23 3700

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Diffusers and Grilles

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 3300, Duct Accessories

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings: Showing dimensions and details of construction.
   2. Product Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Where only Titus figure numbers are listed, equivalent products by the following manufacturers by using only one:
   1. Price
   2. Krueger
   3. Tuttle & Bailey
   4. Metalaire
   5. Nailor
   6. Other Manufacturers: Submit substitution request.

2.02 DIFFUSERS AND GRILLES

A. Ceiling Supply Diffuser (C-1):
   1. Modular diffuser with adjustable modular core, steel panel, square or rectangular neck size as indicated on grille schedule, discharge pattern as indicated, lay-in tee bar ceiling, or surface mounted as required (coordinate with architectural reflected ceiling plan).
   2. White baked enamel finish, Titus MCD.

B. Ceiling Return/Exhaust Grille (C-2):
   1. 1/2-inch by 1/2-inch by 1/2-inch egg crate grille, neck size as indicated on grille schedule, aluminum construction, baked white enamel.
   2. Titus Model 50F.

C. Ceiling Supply Diffuser (C-3):
   1. Square ceiling diffuser, three-cone, 360 degree throw, round neck size as indicated, steel construction, baked white enamel finish.
   2. Titus TMS.

D. Slot Diffuser (S-1):
   1. Extruded aluminum linear slot diffuser with one 1.5-inch slot, adjustable jet throw pattern controller, length and width as indicated on drawings and architectural reflective ceiling plans, Frame and border type 11, concealed flange border, provide end border, end caps, and mitered corners as required, with baked enamel finish, color as selected by architect.
   2. Provide insulated plenum boots, 1/2-inch fiberglass insulation designed by diffuser manufacturer specifically for field attachment to diffuser.
   3. Titus Jet flow FL-10, side wall or ceiling application as shown.

E. Slot Diffuser (S-2):
   1. Extruded aluminum linear slot diffuser with two 1-inch slots, adjustable high throw pattern controller, length and width as indicated on drawings and architectural reflective ceiling plans. Frame and border type 11, concealed flange border, provide end border, end caps, and mitered corners as required, with baked enamel finish, color as selected by architect.
   2. Provide insulated plenum boots, 1/2-inch fiberglass insulation designed by diffuser manufacturer specifically for field attachment to diffuser.
   3. Titus High Throw FL-10, side wall or ceiling application as shown.

F. Slot Diffuser (S-3):
   1. Same as S-1, refer to diffuser schedule for linear slot diffuser dimensions.

G. Slot Diffuser (S-4):
   1. Same as S-2, refer to diffuser schedule for linear slot diffuser dimensions.
   2. Provide anodized aluminum finish.
   3. Slot Return (S, refer to diffuser schedule for linear slot diffuser dimensions

H. Wall Supply Grille (H-1):
   1. Adjustable aluminum double deflection blades, horizontal front with vertical rear blades, 3/4-inch spacing, 1-1/4-inch border, gasketed around face flange, white baked enamel finish.
   2. Titus Model 272FL.

I. Drum Louver (H-2):
   1. Drum louver with 1-1/4-inch steel borders, (opposed blade dampers), counter sunk screw holes, extruded aluminum drum, rotatable 25 degrees up/down form centerline, individually adjustable blades, white baked enamel finish.
   2. Titus model DL.

J. Wall Return/Exhaust Grille (H3):
   1. Aluminum 45 degree fixed single deflection, horizontal blades 3/4-inch spacing 1-1/4-inch border, gasketed around face flange, white baked enamel finish.
   2. Titus Model 3F.

K. Wall Supply Grille (H-4):
   1. Aluminum bar type diffuser with bars fixed at 0 degree deflection.
   2. Diffuser core has 1/8-inch bars and 1/4-inch spacing.
   3. Frame and border type (as noted) with necessary accessories.
   4. Finish standard white or as selected by architect.
   5. Titus CT-480.

L. Wall Return Grille (H-5):
   1. Aluminum bar type diffuser with bars fixed at 0 degree deflection.
   2. Diffuser core has 1/8-inch bars and 1/4-inch spacing.
   3. Frame and border type (as noted) with necessary accessories.
   4. Finish standard white or as selected by architect.
   5. Titus CT-480.

M. Ceiling Return Grille (C-4)
   1. Aluminum 35 degree fixed single deflection, horizontal blades 3/4-inch spacing, lay-in ceiling style mount, with filter access, white baked enamel finish.
   2. Titus Model 350FLF1.

N. Duct Mounted Supply Grille (H-5):
   1. Adjustable aluminum double deflection blades, horizontal front with vertical rear blades, 3/4-inch spacing, 1-1/4-inch border, gasketed around face flange, white baked enamel finish. Direct spiral duct mounted supply grille.
   2. Titus Model S300FS

O. Low Wall Return/Exhaust Grille (L-1):
   1. Heavy duty bar grille, steel 38 degree fixed single deflection, horizontal 14 gauge blades, 1/2-inch spacing, 1-1/4-inch 16 gauge border, steel support bars spaced on 6-inch center. Provide intermediate mullions as required for large grilles.
   2. White baked acrylic finish.
   3. Titus 33RL.

P. Door Grille (L-2)
   1. Steel door transfer grille, sight proof inverted V-blades, heavy duty 20 gauge steel, blades parallel to long dimension.
   2. White baked enamel finish
   3. Accessories: Hinged filter frame on backside of grille, suitable for holding filter material.
   4. Titus Model T-700L

PART 3 EXECUTION

3.01 INSTALLATION

A. Install diffusers tight to their respective mounting surfaces.

B. Installed plumb and true with room dimensions and accurately centered on projections as shown on the Architectural reflected ceiling plans.

C. Install extractors behind duct mounted sidewall supply grilles, and where shown. Turning vanes allowable if condition is the last outlet on a branch.

D. Set pattern control for directions of throw as shown on Drawings prior to air balancer arriving on Project.

E. Paint ductwork behind outlets flat black.

3.02 PERFORMANCE

A. Unit sizing is based on air being introduced at 20 degrees F temperature differential and being diffused at the 5-foot level to a velocity not greater than 50 FPM and a temperature differential not greater than 1.5 degrees F. Units are also selected so as not to exceed the NC-30 curve.

END OF SECTION

SECTION 23 4000

HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Medium Efficiency Pleated Filters
   2. High Efficiency Pleated Filters
   3. Filter Gauge
   4. Side Access Filter Housing
   5. Bipolar Ionization Units

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings: Details of construction and dimensional data.
   2. Product Data: Air filters, gauges, including performance data.
   3. Operation and maintenance data
   4. Provide list of filter quantities and sizes for each unit to 4J no later than substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Medium Efficiency Pleated Filters:
   1. Camfil-Farr 30-30, Cambridge, American Air Filter, Eco-Air Products, Flanders Precisionaire.
   2. Other Manufacturers: Submit Substitution Request.

B. High Efficiency Pleated Filters:
   1. Camfil-Farr
   2. Cambridge
   3. American Air Filter
   4. Eco-Air Products
   5. Flanders Precisionaire

C. Filter Gauge:
   1. Dwyer No. 2002-ASF
   2. Other Manufacturers: Submit substitution request.

D. Side Access Filter Housing:
   1. Eco-Air Surepleat
   2. Camfil-Farr
   3. Cambridge
   4. American Air Filter
   5. Other Manufacturers: Submit substitution request.

E. Bipolar Ionization Units
   1. Global Plasma Solutions
   2. Nu-Calgon
   3. American Ion
   4. Other Manufacturers: Submit substitution request.

2.02 MEDIUM EFFICIENCY PLEATED FILTERS

A. Description:
   1. 2-inch thick medium efficiency, pleated fabric media disposable type filter with support grid and enclosing frame.
   2. UL Class 2.
   3. Size as indicated on drawings.

B. Rating: MERV 8 efficiency rated on ASHRAE Standard 52.1-1992 and 52.2-1999 respectively. Performance: Filters capable of maintaining rated efficiency at 500 fpm face velocity with initial pressure drop not to exceed 0.30-inch wg and final pressure drop at 0.90-inch wg.

C. Frame: Provide complete factory assembled galvanized steel frame assembly suitable for filters, including necessary hardware for supporting and holding filters in place with an air tight seal around frame, [upstream load] [downstream load] on built-up systems, side access on air handling units.

2.03 HIGH EFFICIENCY PLEATED FILTERS

A. Description:
   1. 4-inch, pleated, rigid, replaceable, with glass media, media support grid, contour stabilizers, and galvanized steel enclosing frame.
   2. Size of filter bank as indicated on drawings.

B. Rating: Unit efficiency of 80 percent, MERV 13 minimum rated based on ASHRAE Standard 52.1-1992 and 52.2-1999 respectively.

C. Performance: Filters capable of maintaining rated efficiency at 500 fpm face velocity with initial pressure drop not to exceed 0.39-inch wg and final pressure drop at 0.90-inch wg.

2.04 FRAME: PROVIDE COMPLETE FACTORY ASSEMBLED GALVANIZED STEEL FRAME ASSEMBLY SUITABLE FOR FILTERS, INCLUDING NECESSARY HARDWARE FOR SUPPORTING AND HOLDING FILTERS IN PLACE WITH AN AIR-TIGHT SEAL AROUND FRAME, SIDE ACCESS ON AIR HANDLING UNITS. FILTER GAUGE

A. Description:
   1. Magnehelic Gauge with Plastic Vent Valves
   2. Adjustable Signal Flag
   3. External Front Screw for Zero Adjustment

B. Accessories:
   1. Pressure Tap Plugs
   2. Static Pressure Tips
   3. Tubing
   4. Mounting Adapters with Screws

C. Range: 0 to 2 inches wg, with 0.05-inch divisions.

2.05 SIDE ACCESS FILTER HOUSING

A. Description:
   1. Factory assembled, 16 gauge galvanized steel construction.
   2. Z channel vertical support members on all four corners.
   3. Upstream and downstream outwardly turned flanges for connection to ductwork or air handling unit (weatherproof for outdoor installation).

B. Filter Track:
   1. Extruded aluminum with a replaceable poly-pro gasket to insure sealing of filters to track.
   2. Filter track [2] [4]-inches wide.

C. Access Doors:
   1. Provide on both sides of housing with continuous neoprene gasketing.
   2. Equip with positive-pressure adjustable latches with 1/4 turn handles.

D. Performance: Capacities as shown on drawings [or specify here].

2.06 BIPOLAR IONIZATION UNITS

A. Description: Plasma generator with needlepoint bipolar ionization equipment to control gas phase contaminants by generating equal amounts of positive and negative ions without generation of ozone.

B. Features:
   1. In-line on/off switch
   2. Programmable auto cleaning cycle
   3. Operation status LED
   4. BAS interface alarm contacts
   5. Installation magnets
   6. Replaceable carbon fiber brush emitters

C. Mounting:
   1. To interior wall of air handler supply fan section.

D. Electrical: 24 to 240 volts AC/DC; Maximum 10 watts power consumption

E. Sizing based on GPS:
   1. GPS-FC24-AC up to 2400 cfm
   2. GPS-FC48-AC up to 4800 cfm.
   3. GPS-FC48-AC, quantity 2, from 4800 to 9600 cfm

PART 3 EXECUTION

3.01 INSTALLATION, PLEATED FILTERS

A. Arrange for access and removal of filter elements.

B. Install filters in air handling unit filter racks, filter grilles and other locations shown on the plans.

C. Air handling unit or fans not operated without specified filters properly installed.

3.02 INSTALLATION, FILTER GAUGE

A. Install filter gauge around each filter assembly with static pressure taps for entering and leaving side of filter.

B. Fasten tubing with metal fasteners.

3.03 PROTECTION

A. Equipment Operation During Construction:
   1. Bag Filters:
      a. Provide a treated 2-inch media construction filter in front of prefilters during construction. Replace periodically during construction as required to prevent dirt carryover.
      b. Remove construction filter and replace prefilter prior to air balancing.
   2. Pleated Filters:
      a. If air handlers are operated during construction, replace filters periodically as required to prevent dirt carryover.
      b. Install clean filters prior to air balancing.
   3. Return Filters:
      a. Provide temporary return air filters until time of final cleaning to keep the return duct clean of debris caused during construction.
      b. Once final punch activities are complete, but no sooner than August prior to school opening, replace with new MERV 8 pleated filters.
      c. Provide list of filter quantities and sizes for each unit to 4J no later than substantial completion.

END OF SECTION

SECTION 23 5100

BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Condensing Burner Breeching and Stack

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 22 3000, Plumbing Equipment

D. Section 23 0700, Insulation for HVAC

E. Section 23 5200, Heating Boilers

1.03 SUBMITTALS

A. Submit the following:
   1. Shop drawings showing details of construction.
   2. Product data showing performance data.
   3. Sizing analysis of each system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Condensing Burner Breeching and Stack:
   1. Selkirk Heat-Fab Saf-T Vent
   2. DuraVent FasNSeal W2
   3. Metal Fab Corr/Guard
   4. Schebler eVent
   5. Jeremias DWGV
   6. Van Packer CS
   7. Z-Flex Z-Vent
   8. Security Chimneys Secure Seal
   9. Industrial Chimney VIC
   10. Other Manufacturers: Submit substitution request.

2.02 CONDENSING BURNER BREECHING AND STACK

A. Provide factory built modular connector, double wall, manifold, and stack system complete with tall cone flashing, ventilated thimble, storm collar, rain cap, and complete mounting hardware including mounting bracket, guy wires, and anchor plates.

B. UL 1738 approved for use with Category III and IV heating equipment which produce exhausted flue gases at temperature not exceeding 480 degrees F under continuous operating conditions when burning gaseous fuels. The stack system designed and installed to be gas tight to prevent leakage of combustion products. System designed to compensate for flue gas induced thermal expansions.

C. Stack system constructed of inner gas carrying pipe of type AL29-4C or 316L stainless steel and outer jacket of stainless steel with a minimum 1/2-inch air space between the walls.

D. Inner pipe joints sealed by use of factory supplied V Bands and sealant as specified in manufacturer's installation instructions.

E. Roof penetrations suitable for type of roof system used and according to manufacturer’s detail drawings and installation instructions. Extend stack above roof as required by local codes and as indicated.

PART 3 EXECUTION

3.01 APPLIED LOCATIONS

A. Condensing Burner Breeching and Stack:
   1. Condensing Boilers.
   2. Condensing Water Heaters

3.02 INSTALLATION

A. Install where shown on drawings and where specified in accordance with manufacturer's recommendations.

B. Coordinate sealing of roof penetrations with work specified in Division 07, Thermal; and Moisture Protection.

C. Maintain minimum clearances around stack as required by code and by manufacturer.

D. Support stack horizontally and vertically from structure.

E. Provide adjustable length fittings to compensate for thermal expansion.

F. Brace supports to resist movement of the stack.

G. Generally support stack at bottom and at changes in direction. Intermediate supports to allow for movement.

H. Do not use equipment to support the stack.

I. Provide guying and bracing where required by manufacturer's installation instructions.

END OF SECTION

SECTION 23 5200
HEATING BOILERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Gas Fired Condensing Boiler Unit
   2. Dual-Fuel (Gas and Propane) Condensing Boiler Unit.

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0548, Vibration and Seismic Controls for HVAC Piping and Equipment

D. Section 23 3101, HVAC Ducts and Casing – Low Pressure

E. Section 23 5210, Heating Boiler Accessories

F. Section 23 5100, Breechings, Chimneys and Stacks

1.03 SUBMITTALS

A. Submit the following:
   1. Shop drawings showing details of construction.
   2. Product data showing performance data.
   3. Field Test Reports:
      a. Provide copy of start-up report, including copies of combustion analyzer and efficiency printouts performed at low and high-fire during initial boiler start-up.
      b. Provide copy of installation compliance report for ASME CSD-1.

B. Operating and Maintenance Data.

1.04 TRAINING

A. Provide on-site operation and maintenance training for two identical 4-hour sessions. Coordinate training times with the Owner. Second training may be up to but no later than one year after substantial completion.

B. At the sessions include troubleshooting, repair and maintenance manuals for maintenance personnel. Coordinate quantity required with the Owner.

1.05 WARRANTIES

A. Provide 10-year warranty on heat exchanger and burner to include full replacement covering parts and labor. Warranty burner against burner clog or burn out.

B. Provide 1-year on parts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gas/Propane Fired Condensing Boiler Unit:
   1. Aerco (Benchmark)
   2. Lochinvar (Crest)
   3. Other Manufacturers: The listed manufacturers are School District standard. No substitutions..

2.02 GAS FIRED CONDENSING BOILER UNIT

A. Furnish packaged condensing gas fired type hot water boiler complete, UL labeled, manufactured in accordance with appropriate ASME Heating Boiler Code, stamped for 160 psi water working pressure.

B. Heat Exchanger: 316L stainless steel, fire tube style; single pass, flow through.

C. Combustion blower: Variable speed.

D. Combustion chamber: Completely sealed and enclosed, independent of outer jacket assembly.

E. Furnish steel jacket with baked enamel finish and minimum of 2-inches medium density fiberglass insulation. Capacity as indicated on drawings.

F. Stainless steel burner shall be pre-mix design, capable of minimum (2,000 MBH unit 25:1) turndown of firing rate without loss of combustion efficiency. Boilers shall be capable of standalone operation in the event of a control system failure.

G. Water boiler trim and accessories to include burner/flame observation port, low water cut off, drain valve, combination thermometer and pressure gauge, thermistor supply and return water temperature sensor (pre-installed), system supply header temperature sensor (furnish for field installation), flue temperature sensor, ASME rated safety relief valve(s), drain tapping and condensate drains.

H. Gas Train:
   1. UL/FM approved, safety shut-off valve, air/fuel valve, gas pressure regulator (2 psi is available at the gas train), and nozzle-mix stainless steel burner.
   2. Furnish flame UL monitoring system, and CSD-1 gas manifold control package.

I. Controls:
   1. Provide operating controls and safety devices for automatic operation.
   2. Controls include operating controller, manual reset high temperature limit, electronic flame safeguard control, control circuit transformer, manual reset low water cutoff, and blower motor starter on forced draft units, hi/low gas pressure switch, master switch, airflow switch, water flow switch.
   3. Factory prewired and include operating indicating light, and alarm bell, single point electrical connection in NEMA 1 enclosure.
   4. Electrical characteristics as indicated.
   5. Provide necessary field wiring for a complete system.
   6. UL approved microprocessor flame safeguard programmer with first-out fault annunciation and diagnostic indicator lights.
   7. Provide alarm dry contact for interface to building DDC control system.
   8. Multiple Boiler Sequencing Control Panel:
      a. Provide as part of the packaged boiler control system, microprocessor based lead-lag sequencing system.
      b. Control pre-engineered and programmed exclusively for the operation of multiple hot water full modulation boilers.
      c. Controls permit interface with building DDC control system, as described in Section 23 0900, Controls.
      d. Control system UL-508A listed panel or as integral part of boiler controls.

J. Venting:
   1. Boilers to be capable of being vented into a conventional stack
   2. Sized in accordance with manufacturer's installation recommendations. Refer to Section 23 5100, Breechings Chimneys and Stacks for venting material requirements.

K. Combustion Air:
   1. Boilers to receive combustion air by direct venting.
   2. Refer to Section 23 3101, HVAC Ducts and Casing-Low Pressure for combustion air ducting material requirements.

L. Emissions:
   1. Boiler emissions must be within those allowed by the DEQ and LRAPA.

M. Acoustics:
   1. The boiler sound pressure levels (RE 20 micro Pascal's) when measured 3 feet in front of the boiler should not exceed the following:

Octave Band 1	1	2	3	4	5	6	7	8	NC
Center Frequency	63	125	250	500	1000	2000	4000	8000	
Level	46	57	64	67	64	62	58	45	69

N. Condensate Management System:
   1. Provide neutralizer kit to ensure condensate discharge controlled to a pH range of 6.5-7 before discharge into the drainage system.
   2. Use materials approved by the authority having jurisdiction.
   3. Provide Owner with a one year supply of condensate neutralizer (reagent grade calcium carbonate).
   4. Based on: JJM Boiler Works JM Series.

O. Automatic Shut Off Valve
   1. Manufacturer's 2-way motorized shut off valve and relay kit for each boiler
   2. Size: To match boiler connections.
   3. Ship valve loose, for field installation.

2.03 DUAL-FUEL BOILER (PROPANE AND NATURAL GAS)

A. Boilers scheduled as dual-fuel shall be by the same manufacturer as single-fuel boiler.

B. Boiler scheduled as dual-fuel shall be furnished capable of manual switchover from one fuel to the other without requirement of adjustment to burner, blower, or related equipment.

C. Boiler shall have separate propane and natural gas piping connections, with independent shut off valves.

D. Boiler control panel shall be utilized, with suitable password, to make the switchover.

E. Boiler control panel shall include visual indicator of fuel selection.

F. Dual fuel boiler shall be set up as the Master boiler.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's instructions for installation.

B. Boiler:
   1. Install in accord with manufacturer's recommendation to provide adequate clearance and accessibility.
   2. Mount on 4-inch concrete housekeeping pad.
   3. Refer to equipment schedule for vibration isolation requirements.
   4. Pad size per boiler manufacturer's instructions.
   5. Install necessary drains, blow downs, chemical feed piping, and safety valve, as required for a complete installation.

C. Pipe valved drain from boiler, to condensate receiver, then to nearest floor drain.

D. Connect ICW to condensate receiver.

E. Pipe hot water boiler relief valve outlet to over nearest floor drain.

F. Install and wire feed water regulating valve with required piping, valves, strainer, check valve, manual bypass valve as indicated.

G. Drawings indicate a location of boiler flue based on assumption. If boilers supplied have different flue gas location, redesign and relocate stack at no additional cost.

3.02 START-UP

A. General: Comply with manufacturer's instructions for start-up.

B. Provide start-up under the direct supervision of the manufacturer's representative.

C. At completion of start-up submit written record of startup performance including percent CO2, CO, and O2, stack temperature, and combustion efficiency.

D. Manufacturer representative to demonstrate operation of controls, interlocking, and flame safeguard.

3.03 CLEANING

A. After installation and before start-up thoroughly clean boilers of scale, grease, etc. and boil out in manner and for duration as recommended by manufacturer.

3.04 INSPECTION

A. Subject boiler to hydrostatic pressure test in presence of authority having jurisdiction. Tests conform to ASME Boiler Code and other applicable codes.

END OF SECTION

SECTION 23 6400

PACKAGED WATER CHILLERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Air Cooled Water Chiller

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0548, Vibration and Seismic Control for HVAC Piping and Equipment

D. Section 23 0900, Controls

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings showing complete details of construction.
   2. Catalog data showing performance data.
   3. Part load operating characteristics: both the integrated part load value (IPLV), and non-standard part load value (NPLV) calculation per AHRI Standard 550/590.
   4. Operating and Maintenance Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Air Cooled Water Chiller:
   1. Carrier
   2. Trane
   3. York (JCI)
   4. Other Manufacturers: Submit substitution request.

2.02 AIR COOLED WATER CHILLER

A. Description:
   1. Complete packaged scroll type air cooled water chiller, consisting of compressors, air-cooled condensers, refrigerant piping and specialties, and controls, contained on a common frame.
   2. Provide one-piece integral unit.
   3. Fully charge unit with refrigerant at factory.
   4. Construct in accordance with ANSI B9.1 Safety Code for Mechanical Refrigeration.
   5. Contain wiring and piping within unit enclosure.
   6. Mount electrical components in a rain-tight enclosure.
   7. Exterior sheet metal, galvanized steel, with an electro-statically applied baked enamel finish.

B. Compressors:
   1. Sealed hermetic, scroll type with crankcase oil heater and suction strainer.
   2. Motor: Refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases, mounted on RIS vibration isolator pads.
   3. Protection: Internal module providing compressor protection and communication capability.

C. Motors:
   1. Continuous duty induction type to match compressor torque curves, cooled by full flow of suction gas and suitable for voltage fluctuation of plus or minus 10 percent of nameplate voltage.

2. Provide solid state sensor in each motor winding to protect against excess winding temperatures.

D. Evaporator:
   1. Type: Compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates.
   2. Freeze Protection: Electric resistance immersion heater, insulated with 3/4-inch thick sheet insulation protecting against water freeze-up at ambient air temperatures to -20 degrees F. A fluid thermostat shall control the heater.
   3. Certification: Water side working pressure shall be minimum 653 psig. Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor. Evaporators shall be designed and constructed according to, and listed by, Underwriters Laboratories (UL).

E. Air-Cooled Condensers:
   1. Coils: All aluminum alloy microchannel design with series of flat tubes containing multiple, parallel flow microchannels layered between refrigerant manifolds.
   2. Fans: Single piece, composite, propeller type arranged for vertical air discharge and individually driven by direct drive fan motors. Each fan shall be in its own compartment to eliminate cross flow of condenser air during fan cycling and shall be equipped with a heavy-gauge vinyl coated fan guard.
   3. Motors: Weather protected, three-phase, direct-drive, 1140 rpm, TEAO type with permanently lubricated ball bearings and inherent overload protection. External coil surfaces shall have wire mesh protective guards.
   4. Fins: Rippled aluminum.

F. Refrigerant Circuit: Each refrigerant circuit shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), thermal expansion valve, and insulated suction line.

G. Construction
   1. Unit casing and all structural members and rails: Fabricated of steel and painted to meet ASTM B117, 500-hour salt spray test.
   2. Upper condenser coil section of unit: Protective, 12 ga, PVC-coated, wire grille guards.

H. Control System
   1. Control Panel: Centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Power and starting components shall include factory circuit breaker of fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.
   2. Connection: Single-point connection to a non-fused disconnect switch with through-the-door handle and compressor circuit breakers.

I. Unit Controller: DDC microprocessor unit controller with minimum 4-line by 20-character liquid crystal display. The controller shall take pre-emptive limiting action in case of high discharge pressure or low evaporator pressure.
   1. Equipment Protection:
      a. By alarms that shut the unit down and require manual reset to restore unit operation and
      b. By limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.
   2. Shutdown Alarms
      a. No Evaporator Water Flow - Auto-Restart
      b. Sensor Failures
      c. Low Evaporator Pressure

d. Evaporator Freeze Protection
e. High Condenser Pressure
f. Outside Ambient Temperature - Auto-Restart
g. Motor Protection System
h. Phase Voltage Protection - Optional

3. Limit Alarms
   a. Condenser pressure stage down, unloads unit at high discharge pressures.
   b. Low ambient lockout, shuts off unit at low ambient temperatures.
   c. Low evaporator pressure hold, holds stage 1 until pressure rises.
   d. Low evaporator pressure unload, shuts off one compressor.
4. Unit Enable Selection
   a. Enables unit operation from either local keypad, digital input, or BAS
5. Analog Inputs:
   a. Reset of leaving water temperature, 4-20 mA
   b. Current Limit
6. Digital Inputs
   a. Unit Off Switch
   b. Remote Start/Stop
   c. Flow Switch
   d. Motor Protection
7. Digital Outputs
   a. Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
8. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.
9. Building Automation System (BAS) Interface
   a. Factory mounted DDC controller(s) shall support operation on a BACnet network via BACnet MS/TP master (Clause 9), BACnet IP, (Annex J), or BACnet ISO 8802-3, (Ethernet).
   b. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
   c. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

J. Options and Accessories to be included:
   1. BAS interface module to provide interface with the BACnet/IP protocol.
   2. Evaporator inlet strainer, 40-mesh with extension pipe and Victaulic couplings.
   3. Separate 120V connection to factory-installed freeze prevention heaters.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's instructions for installation.

B. Pipe Connections: Arrange connections to chiller to prevent pipe weight or stresses from being transferred to chiller and to provide easy access for tube cleaning.

C. Water Treatment: Treat chilled water system as specified.

D. Strainer: Install manufacturer-supplied strainer in chilled water return line at evaporator inlet; 40-mesh on units with brazed-plate evaporators or 20-mesh on shell-and-tube evaporators.

3.02 START UP

A. General: Comply with manufacturer's instructions for startup.

B. Start-up provided under the direct supervision of the manufacturer's representative with factory trained personnel.

C. Provide four hours of training to school district personnel.

3.03 FIELD QUALITY CONTROL

A. Prior to installation, manufacturer's representative coordinate chiller control interface and verify that intended installation (controls, piping, etc.) complies with the manufacturer's recommendations.

B. Field Test:

1. Except where initial chiller operation clearly shows the performance meets or exceeds the requirements, test to show compliance.
2. Tests performed by the manufacturer's representative in the presence of the Engineer.

END OF SECTION

SECTION 23 7000

CENTRAL HVAC EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Modular Indoor Air Handing Units
   2. Small Indoor Air Handling Units

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0514, Variable Frequency Drives for HVAC Systems

D. Section 23 0548, Vibration and Seismic Controls for HVAC Piping and Equipment

E. Section 23 0700, Insulation for HVAC

F. Section 23 0900, Controls

G. Section 23 3319, Duct Silencers

H. Section 23 4000, HVAC Air Cleaning Devices

I. Section 23 8200, Convection Heating and Cooling Units

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings showing details of construction, dimensions, arrangement of components, and isolation.
   2. Product Data
   3. Operating and Maintenance Data
   4. Specified Testing Requirements

PART 2 PRODUCTS

2.01 MODULAR INDOOR AIR HANDLING UNITS

A. Manufacturers:
   1. Daikin Vision
   2. Trane Climatechanger
   3. BasX
   4. York Solution
   5. Aaon M2
   6. Other Manufacturers: Submit substitution request.

B. Description:
   1. Variable volume, single zone draw-through modular air handling units consisting of fan sections, coil sections, filter sections, motor and drive, and mixing box where shown, all contained in an insulated steel casing and mounted on a common steel base. Arrange components as specified hereafter and as shown on the Drawings.
   2. Air Moving and Conditioning Association rated.

C. Unit Casing:
   1. Casing of 24 gauge steel, double-wall construction with formed C-channel base rails, 6 to 10-inches high as needed to support equipment.
   2. Provide access doors for inspection of fan and motor.
   3. Manufacturer’s standard factory finish.
   4. Insulation of entire cabinet shall be R-13 foam injected between the two casing walls, creating a rigid panel.
   5. Drain pan under cooling coils with 2-inch cellular, foam-in place insulation.

6. Arranged with motor and drive inside fan casing; isolated fan and motor assembly within unit casing.

D. Fans:
   1. Fan type and capacity as indicated on the drawings.
   2. Statically and dynamically balanced in its own bearings with a maximum full amplitude shaft deflection at bearings not to exceed 0.001-inch at 1200 RPM.
   3. Grease lubricated, self-aligning, interior mounted pillow block or flanged bearings permanently sealed.
   4. Provide spherical roller bearings on units of 25 horsepower and larger, 80,000 hour L-10 life per AFBMA Standards.

E. Motor:
   1. Integrally mounted 1800 rpm motor, with pre-lubricated sealed ball bearings.
   2. Refer to Section 23 0500, Common Work Results for HVAC for energy efficient motor requirements.
   3. EC motors where scheduled. Standard motor controlled by VFD.

F. Direct Drive: Direct drive matched to fan loads.

G. Vibration Isolators:
   1. Provide as an integral part of each unit. Refer to Section 23 0548, Vibration and Seismic Controls for HVAC Piping and Equipment.
   2. Coordinated weights and location of support points with the vibration isolation equipment supplier.

H. Water Coils: See Schedule for capacities and Section 23 8200, Convection Heating and Cooling Units for specification.
   1. Provide drain pan for each level of cooling coils. Drain pans constructed from stainless steel or galvanized steel coated with asphalt or approved rust inhibitor.
   2. Drain pan double sloped, in direction of air flow and toward drain connection.
   3. Coils: Maximum 10 fins per inch.

I. Filters:
   1. Provide space and individual rails to accommodate 2-inch MERV or 4-inch MERV 13 filters.
   2. See Schedule for sizes and Section 23 4000, HVAC Air Cleaning Devices for specification.
   3. Provide suitable access doors, slide rack, and sealant strips for filters specified.

J. Flexible Connections:
   1. Constructed in accordance with UL181, Class I air duct with flanged connections.
   2. Flexible, neoprene-coated glass fabric not lighter than 30 ounce/square yard.
   3. Ventglas by Vent-Fabrics, Inc.

K. Mixing Boxes:
   1. General: Provide multi-blade dampers as shown on Drawings and as required to perform functions as specified in Section 23 0900, Instrumentation and Controls for HVAC.
   2. Arrange return air and minimum outside air dampers to discharge against each other for maximum mixing in the mixing box prior to the coil.
   3. Provide coordinated spring-return damper actuators, Belimo low-voltage.

L. Sound Requirements:
   1. Furnish sound power levels at the supply air connection, return air connection, and casing radiation for each air handling unit.

M. Bipolar Ionization Units: Provide with each unit as specified in Section 234000 and as scheduled.

2.02 SMALL INDOOR AIR HANDLERS

A. Acceptable Manufacturers:
   1. Thermal Corporation HBC horizontal blower coils, Aaon H3, BasX.
   2. Other Manufacturers: Submit Substitution Request.

B. General Description
   1. Include filters, supply fans, return fan (where indicated), chilled water coil, mixing box, and unit controls.
   2. Draw-through supply fan configuration and discharge air horizontally or vertically as indicated on drawings and schedules.
   3. Factory assemble and test including leak testing of the chilled water coil and run testing of the fans and factory wired electrical system. Run test report shall be supplied with the unit.

C. Construction
   1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
   2. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610 degrees F.
   3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
   4. Design unit to reduce air leakage and infiltration through the cabinet. Include sealing between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels include sealing to reduce air leakage.
   5. Access to filters, cooling coil, fans, and electrical and controls components shall be through hinged access doors.
   6. Access Doors:
      a. Flush mounted to cabinetry.
      b. Filter, coil, and supply fan access doors shall include quarter-turn lockable handles.
      c. Supply and return fan access door includes removable pin hinges.
   7. Units with a cooling coil shall include sloped 304 stainless steel drain pan. Drain pan connection shall be on the side of unit.
   8. Cooling coil shall be mechanically supported above the drain pan by multiple supports that allow drain pan cleaning and coil removal.

D. Electrical
   1. Provide unit with an internal control panel adjacent to blower compartment to accept low voltage and power. Adequate space shall be provided for the DDC controller to be field installed in the panel. Controller dimensions are 6-inch by 6-inch.
   2. Provide with standard power block for connecting power to the unit.
   3. Factory install 24V control circuit transformer, minimum 100 VA.

E. Supply and Return/Exhaust Fans
   1. Direct drive, unhoused, backward curved, plenum fan.
   2. Blower and motor assembly shall be dynamically balanced.
   3. Blower and motor assembly shall be isolated with neoprene gasket.
   4. High efficiency electronically commutated motor (ECM).

F. Cooling Coil
   1. Chilled Water Cooling Coil
      a. Certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.
      b. Constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.

c. External piping connections. Supply and return connections shall be sweat connection. Coil connections shall be labeled, extend beyond the unit casing, and be factory sealed on both the interior and exterior of the unit casing, to minimize air leakage. See drawings and schedules for service side of unit.
d. Maximum of 10 fins per inch.
e. Coil drain pan condensate connection to be 3/4-inch.

G. Filters
1. Provide space and individual rails to accommodate 2-inch MERV or 4-inch MERV 13 filters.
2. Refer to Section 23 4000, HVAC Air Cleaning Devices. Additional pleated filters shall be furnished loose, as described in Section 23 4000, HVAC Air Cleaning Devices.
3. Unit includes a clogged filter switch.
4. Include factory installed Magnehelic gauge measuring the pressure drop across the filter rack.

H. Mixing Box
1. Unit shall contain a mixing box with top opening and front or side opening, as indicated, which may be used for either outside air or return air.
2. Return air opening shall contain an adjustable, motor operated return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven. Dampers shall be fixed position controlled by a fully modulating actuator. Actuator to be Belimo, low voltage.
3. Outside air opening shall contain an adjustable, motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven. Dampers shall be fixed position controlled by a fully modulating actuator. Actuator to be Belimo, low voltage.
4. Dampers on air handlers less than 2000 cfm only require a spring return actuator on the outside air damper. Return air damper may be either spring return or non-spring. Units larger than 2000 cfm require coordinated spring return actuators on all mixed air dampers.

I. Bipolar Ionization Units: Provide with each unit as specified in Section 23 4000 and as scheduled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Indoor Air Handling Unit:
1. Install with air filters in place before operating unit.
2. Mount on steel base which may be integral with unit.
3. Pipe drain pan to floor drain with 3-inch minimum trap seal.
4. Small air handlers shall be mounted to a minimum of two six-inch-high 12 gauge sheet metal sleepers that are themselves secured to floor, as detailed.
5. Mount units with adequate clearance to allow for full opening of access doors.

B. Flexible Connections:
1. Provide flexible connections between fans and the connected ducts or plenums.
2. Install with 1-inch space between the fan and connecting duct with fabric snug but not stretched tightly.
3. Provide accurate alignment between fan and duct.
4. Secure in place with flanged connections. Do not crimp into the duct construction. Ends of the screws shall not project into the duct more than 1/8-inch.

END OF SECTION

SECTION 23 8100

DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Split System Air Conditioning Unit

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

C. Section 23 0514, Variable Frequency Drives for HVAC Equipment

D. Section 23 0548, Vibration and Seismic Controls for HVAC Piping and Equipment

E. Section 23 8200, Convection and Heating and Cooling Units

F. Section 23 0900, Controls

1.03 SUBMITTALS

A. Submit the following:
   1. Shop drawings showing details of construction, dimensions, arrangement of components, isolation, filters, etc.
   2. Product data showing performance data, standard items, and accessories, operating weight.
   3. Flow diagrams and pipe sizing for refrigerant systems.
   4. Operating and maintenance data.
   5. Testing Submittals:
      a. Provide test plan and test procedures for approval.
      b. Explain in detail, step-by-step, actions and expected results to demonstrate compliance with the requirements of this specification and methods for simulating necessary conditions of operation to demonstrate performance of the system.
      c. Test plan and test procedures demonstrate capability of system to monitor and control equipment and to accomplish control and monitoring specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Split System Air Conditioning Unit:
   1. Carrier
   2. Trane
   3. Lennox
   4. Other Manufacturers: Submit substitution request.

2.02 SPLIT-SYSTEM AIR CONDITIONING UNIT

A. Indoor Unit:
   1. Description:
      a. Furnish complete unit including cabinet, wall mounting kit and accessories, refrigerant line set, fan and motor assembly, cooling coil and filter.
      b. Unit as scheduled on drawing, factory-tested and assembled, factory wired, refrigerant-to-air heat exchanger, fan/motor assembly, compressor, controls and safety devices, control circuit transformer, shipped in one piece with ARI certification and UL listing.
   2. Cabinet: 18 gauge steel, removable panels for access to components. Drain connection and return air filter racks.
   3. Fan and Motor:
      a. Assembly with a turbo fan direct driven by a single motor.

b. Statically and dynamically balanced and run on a motor with permanently lubricated bearings.
c. Fan consists of two speeds:
1) High
2) Low.

4. Mixing box: Provide manufacturer's standard economizer section with return air and outside air dampers. Outside air dampers to be low-leak per Oregon Energy Code. Actuators will be provided by Owner. Alternatively, depending on configuration, dampers may be in ductwork remote from unit.
5. Controls:
a. Run wiring direct from the indoor unit to the controller with no splices.
b. System capable of automatic restart when power is restored after power interruption
6. Condensate Pump: Provide condensate pump when required; pipe drain as indicated.
7. Condensate Drain Pan Sensor: Provide secondary condensate drain pan sensor interlocked to turn off unit upon detection.

B. Outdoor Unit:
1. Description:
a. Provide air-cooled air conditioner (outdoor unit) designed for outdoor installation with factory-supplied supports, properly assembled, and tested at the factory.
b. Completely weatherproofed and include compressor, condenser coils, condensing fans, motor, refrigerant reservoir, charging valve, controls, and a holding charge of R410A.
c. Provide guards on condenser fans and coil guard.
2. Compressors:
a. Furnish hermetically sealed type with isolation and sound muffling.
b. Overload and inherent winding thermostat protection to prevent burn out.
c. Provide crankcase heater.
d. Two-stage compressors.
3. Refrigeration Circuits: Back seating service valve and gauge ports in liquid and suction lines. Provided refrigerant filter-dryer.
4. Condenser Fans and Motors: Direct driven propeller type fans with permanently lubricated motors.
5. Controls:
a. Provide high and low pressure cutouts, contactors and internal overload protection on motors.
b. Provide short cycle timer.

C. Controls Interface:
1. DDC System will interface with indoor/outdoor units through thermostat terminals.

D. Electrical:
1. Arrange for single point electrical connections.
2. Provide power and control wiring.

2.03 CONDENSATE OVERFLOW PROTECTION

A. Provide a switch intended to shut down operation of the condensing unit upon detection of either a blocked main condensate drain line, blocked overflow drain line, or high level in the indoor unit drain pan.

PART 3 EXECUTION

3.01 SPLIT-SYSTEM AIR CONDITIONING UNIT

A. Installation:
1. Install in location shown on the Drawings. Level unit and secure to structure.
2. Make piping connections and unit installation per manufacturer's recommendations and installation guides.

3. Size and run refrigerant piping between fan coil unit(s) and air-cooled condensing unit(s) per manufacturer's recommendations.
4. Insulate refrigerant piping as specified in Section 23 0700, Insulation for HVAC.
5. Pipe condensate as indicated.
6. Make refrigerant piping connections, install refrigeration accessories, and charge system. Provide additional refrigerant as required for proper operation at design capacities.

B. Start-up:
1. General: Comply with manufacturer's instructions.
2. Install filters before operating unit.
3. Insure proper refrigerant and airflow before operating unit compressor.

C. Provide interconnecting power and control wiring, routed in conduit from the outdoor unit to the indoor unit, and control panel thermostat. Where unit provided requires separate power connections to the indoor and outdoor units provide at no additional cost. Include branch circuit conduit, wiring, circuit breaker, terminations, etc. as required for complete system. Branch circuit serving indoor unit originates in same panelboard serving outdoor unit.

D. Testing and Adjusting/Performance Test: Except where initial unit operation clearly shows the performance meets or exceeds the requirements, test to show compliance.

END OF SECTION

SECTION 23 8200

CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Heating/Cooling Coils, Water
   2. Cased Duct-mounted Heating/Cooling Coils, Water

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Submit the following:
   1. Catalog data showing dimensions and performance.
   2. Computer calculations for coil performance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1. Cooling and Heating Coils, Water:
   a. USA CoilTrane
   b. Daikin-McQuay
   c. JCI-York
   d. Heatcraft
   e. Greenheck
   f. CES Group
   g. RAE Coils
   h. Other Manufacturers: Submit substitution request.

2.02 HEATING/COOLING COILS, WATER

A. Coils of nonferrous extended surface construction with continuous 16 gauge galvanizedsteel casing for installation in air supply unit or ductwork as shown on Drawings.

B. Primary surface of seamless copper tubing rolled into headers with copper bushings or brazed into nonferrous headers.

C. Fins: Nonferrous, mechanically bonded to tubes, with fin spacing of 10 fins per inch maximum.

D. Coils tested at 300 psi hydrostatic pressure, guaranteed for 250 psi working pressure.

E. Arranged for serpentine flow in continuous circuits with counterflow between air and water without turbulating means; provide air vents at each coil.

F. Supply and return connections on same side, with supply on bottom, downstream of air flow.

G. 0.008-inch minimum fin thickness; 0.024-inch minimum tube wall thickness; 0.035-inch straight stock for U-turns.

H. Capacity certified in accordance with ARI Standard 410-72. Face velocity not to exceed 500 fpm at specified air flow.

2.03 CASED, DUCT-MOUNTED HEATING/COOLING COILS

A. Description: Self-contained cooling coil with flanges for duct-mounting, including integral drain pan.

B. Construction
   1. Per heating/cooling coil specification above plus following requirements.
   2. Cabinet: 16 gauge galvanized steel exterior with 18 gauge galvanized steel interior.
   3. Insulation: Two-inch fiberglass, encapsulated with double wall envelope.
   4. Access: Coil removal by access panel at header end.

5. Drain Pan:
    a. 18 gauge stainless steel, double-pitched to single low point.
    b. Pan to extend beyond coil within cabinet for a minimum of 1/3 of coil fin height.
6. Pan Drainage: 3/4-inch stainless steel condensate drain coupling, plus separate 3/4-inch overflow drain coupling.
7. Duct Connections: 1-1/2-inch duct flanges on entering and leaving side of coil housing.
8. Coil Connections: Extend min 4-inches beyond box exterior.
9. Vent: Minimum1/4-inch brass vent and drain.
10. Suspension: Hanging brackets at each corner of top of cabinet.
11. Coils for heat recovery application shall have 0.0095-inch thick flat fins.

PART 3 EXECUTION

3.01 INSTALLATION

A. Heating/Cooling Coils: Installed in air handling units as standard with manufacturer or in ductwork as shown.

B. Duct-mountedHeating Coils: Provide condensate drain as shown on plans. Route secondary drain daylit location wherever coil overflow could cause damage to building structure.

C. Damaged Coils: Make every effort to prevent damage to both built-up coils and coils of packaged equipment. Comb damaged coil fins to be straight.

END OF SECTION

SECTION 23 8410
ELECTRIC HEATING EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Electric Unit Heaters
   2. Heat Trace Cable

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 23, Heating, Ventilating, and Air Conditioning (HVAC)

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings: Showing details of construction and dimensional data.
   2. Product Data: Showing performance data, ratings, electrical data, wiring diagrams, fusing quantity and types.
   3. Operating and Maintenance Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Electric Unit Heaters:
   1. Indeeco
   2. Markel
   3. Chromalox
   4. Trane
   5. Modine
   6. Reznor
   7. Redd-i
   8. Q-Mark
   9. Other Manufacturers: Submit substitution request.

B. Heat Trace Cable:
   1. Chromalox
   2. Raychem
   3. Nelson
   4. Other Manufacturers: Submit substitution request.

2.02 ELECTRIC UNIT HEATERS

A. Description:
   1. Horizontal or vertical discharge as indicated on drawings, complete with fan, motor, heavy gauge steel casing with adjustable discharge louvers, tubular finned heating element, automatic reset thermal overloads, and control circuit transformer.
   2. Capacity as indicated.
   3. UL listed and wired per NEC.

B. Thermostat: Unit mounted built-in, adjustable.

2.03 HEAT TRACE CABLE

A. Cable:
   1. Self-regulating flat, flexible, low-heat density, parallel electric heater strip consisting of two stranded circuit conductors enclosed in a semi-conductive, polymer core insulated with a plastic jacket protected with a tinned-copper braid.
   2. Capability of being overlapped without creating hot spots and shall be suitable for application on plastic, copper or steel pipe.

3. Manufacturers:
    a. Raychem XL-Trace
    b. Chromalox SRF
    c. Or approved equal.

B. Voltage: Cable operates on single phase line voltage of 208 VAC without transformation. Provide power connections, end seals, splices tap-offs and tees as furnished by the manufacturer.

C. Controls:
1. System control for freeze protection includes a thermostat with fixed setpoint of 40 degrees F.
2. Thermostat: Nickel-plated copper bulb at end of 36-inch capillary and shall be enclosed in a NEMA 4 enclosure. Raychem AMC-F5, Chromalox PIT or approved.

PART 3 EXECUTION

3.01 ELECTRIC UNIT HEATER

A. Suspend from structure with 5/8-inch diameter rods and per manufacturer instructions.

B. Install thermostat as shown on drawings. Provide control wiring from thermostat to unit.

3.02 HEAT TRACE CABLE

A. Location: Provide heat trace on piping in unheated spaces as shown or required to prevent freezing.

B. Install heat trace cable on pipes indicated to maintain a minimum of 35 degrees F in ambient temperature of 0 degrees F. Lay cable parallel on pipe or spiral wrap to maintain adequate temperature as required by pipe size and thermal properties of the pipe insulation to be applied.

C. Attach heat trace cable to pipe with polyester tape at increments not exceeding 1-foot.

D. Install thermostat capillary and bulb to pipe with polyester tape assuring a firm bulb contact with pipe. Bulb not in contact with heat cable.

E. Install thermostat at accessible location adjacent to pipe with a minimum of exposed capillary. Tape capillary to pipe run under insulation to bulb.

F. Installer responsible for affixing an electric traced label to the outside of the pipe's thermal insulation on alternating sides at intervals of five to fifteen feet immediately after the piping has been insulated.

G. Coordinate installation with work under Division 26, Electrical for adequate electrical service to each thermostat.

END OF SECTION

SECTION 26 0500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

A. The intent of Division 26, Electrical Specifications and Drawings is to provide a complete and workable facility, with complete systems as required by applicable codes, as indicated, and as specified.

B. Include work specified in Division 26, Electrical and as indicated on Drawings. Include appurtenances, connections, fasteners, and accessories required to make a complete working system, whether indicated or not indicated.

C. Refer to Division 01, General Requirements.

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

1.03 REFERENCES

A. The latest adopted revisions of the publications listed below apply to these Specifications as referenced:

1.	IBC	International Building Code
2.	NEC	National Electrical Code
3.	NFPA	National Fire Protection Association
4.	NEMA	National Electrical Manufacturers Association
5.	NECA	National Electrical Contractors Association
6.	ANSI	American National Standards Institute
7.	IEEE	Institute of Electrical and Electronic Engineers
8.	UL	Underwriters Laboratories

1.04 SYSTEM DESCRIPTION

A. Ground Systems:
   1. Provide complete ground systems indicated.
   2. Include conduit system, transformer housings, switchboard frame, and neutral bus, motors, and miscellaneous grounds required by Contract Documents and by applicable codes.

B. System Identification:
   1. Clearly identify elements of the Project electrical system to indicate the loads served, or the function of each item of equipment, connected under this work.
   2. Comply with requirements of Division 26, Electrical, and with applicable codes.

C. Drawings:
   1. Drawings are diagrammatic. They do not show every offset, bend, tee, or elbow, which may be required to install work in the space, provided and avoid conflicts with other construction.
      a. Prior to installing work, take field dimensions, and note conditions available for, installation.
      b. Follow the Drawings as closely as practical to do so, and install additional bends, offsets, and elbows where required by installation conditions.
         1) Additional offsets, bends, and other connectors are subject to approval by Project Engineer.
         2) Install additional offsets, bends, and other connectors without additional cost to Owner.
      c. The right to make any reasonable changes in outlet location prior to roughing in is reserved to the Owner's Representative.

2. Luminaire Designations:
    a. Lower case letters adjacent to devices or luminaires indicate switching arrangement or circuit grouping.
    b. Numbers adjacent to devices indicate circuit connection.
3. Circuits and Switching:
    a. Do not change branch circuiting and switching indicated; nor combine homeruns, without Engineer's prior approval.
    b. Do not combine or change feeder runs.
4. Circuit Conductors:
    a. Cross or hash marks on conduit runs indicate quantity of No. 12 copper branch circuit conductors, unless otherwise noted.
    b. Where such marks do not appear, provide quantity of circuit conductors to the outlets shown to perform the control or circuiting indicated.
    c. Include ground, travelers, and switch legs required by the circuiting arrangement indicated.
    d. Provide a dedicated neutral conductor with each circuit. Do not use a shared neutral conductor between phases unless, requested or directed.

1.05 SUBMITTALS

A. Comply with Division 01, General Requirements.

B. Contractor Responsibilities:
1. Submit submittals one time and in proper order.
2. Ensure equipment will fit in the space provided.
3. Deviations from the Drawings and Specifications specifically noted in the submittals. Failure to comply will automatically void any implied approval for use of the equipment on this project.

C. Shop Drawings and Equipment Data:
1. Combine electrical shop drawings and equipment data in Submittal binders.
2. Include in Submittal binders:
    a. Complete index of materials and equipment as required by Specifications to be documented by submittals.
    b. Fully describe equipment furnish per manufacturer's detailed specifications.
    c. All deviations from the Drawings and Specifications, noted on the submittals. Failure to comply will automatically void any implied approval for use of the equipment on this project.

D. Installation Drawings:
1. Submit prior to starting installation.
2. Show outlets, devices, terminal cabinets, conduits, wiring, and connections required for the complete system described.

E. Record Drawings:
1. Keep record drawings up to date as the work progresses.
2. Show changes, deviations, addendum items, change orders, corrections, and other variations from the Contract Drawings.
3. Keep record drawings at the jobsite and available for the Architect's review.
4. At the completion of the work, incorporate all deviations from the installation drawings to indicate as-built conditions.

F. Operation and Maintenance Data:
1. As specified in Division 01, General Requirements.
2. Provide a separate manual or chapter for each system as follows:
    a. Low Voltage Distribution System
    b. Emergency Power System
    c. Standby Power System
    d. Fire Alarm System

e. Lighting System
f. Lighting Control System
g. Power Metering And Monitoring System
h. UPS System

3. Description of system.
4. Operating Sequence and Procedures:
   a. Step-by-step procedure for system start-up, including a pre-start checklist.
      1) Refer to controls and indicators by nomenclature consistent with that used on panels and in control diagrams.
   b. Detailed instruction in proper sequence, for each mode of operation (i.e., day-night, staging of equipment).
   c. Emergency Operation:
      1) If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under those conditions.
      2) Include here only those alternate methods of operations (from normal) which the operator can follow when there is a partial failure or malfunctioning of components or other unusual condition.
   d. Shutdown Procedure:
      1) Include instructions for stopping and securing the equipment after operation.
      2) If a particular sequence is required, give step-by-step instructions in that order.
5. Preventive Maintenance:
   a. Schedule for preventive maintenance.
      1) State the recommended frequency of performance of each preventive maintenance task such as cleaning, inspection, and scheduled overhauls.
   b. Cleaning: Provide instructions and schedules for all routine cleaning and inspection with recommended lubricants.
   c. Inspection: If periodic inspection of equipment is required for operation, cleaning, or other reasons, indicate the items to be inspected and give the inspection criteria.
   d. Provide instructions for lubrication and adjustments required for preventive maintenance routines. Identify test points and given values for each.
6. Manufacturers' Brochures:
   a. Include manufacturers' descriptive literature covering devices and equipment used in the system, together with illustrations, exploded views, and renewal parts lists.
   b. Clearly define manufacturers' standard brochures so that the information applying to the actual installed equipment.
7. Results of performance testing, as specified in PART 3 of this Section.

G. Submittals Procedures:
   1. Review and recommendations by the Architect or Engineer are not to be construed as change authorizations.
   2. Either if discrepancies are discovered between the materials or equipment submitted, and the Contract Documents, prior to or after the data is processed, the Contract Documents govern.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Products and equipment comply with Oregon Revised Statute (ORS) 453.005(7)(e) prohibiting pentabrominated, octabrominated, and decabrominated diphenyl ethers. Where products or equipment within this specification contains these banned substances, provide complying products and equipment from approved manufacturers with equal performance characteristics.
   2. Provide work and materials conforming to:
      a. Local and State codes.
      b. Federal and State laws and regulations.
      c. Other applicable laws and regulations.

3. Obtain and pay for all permits, licenses, and inspection certificates required by authorities having jurisdiction.
4. Pay any other fees required by governing authorities for work of this Division.

B. Install only electrical products listed by a recognized testing laboratory, or approved in writing by the local inspection authority as required by governing codes and ordinances.

1.07 SITE VISITATION

A. Visit the site prior to bidding and become familiar with existing conditions and other factors which may affect the execution of the work. Complete coordination of installation of equipment with prior bid packages previously issued. Include related costs in the initial bid proposal.

1.08 COORDINATION

A. Coordinate Work of This Division with all other trades to ensure proper installation of electrical equipment.
1. Review Drawings of other trades or crafts to avoid conflicts with cabinets, counters, equipment, structural members, and other possible impediments to electrical work.
2. Report potential conflicts to the Architect prior to rough-in.
3. Proceed with rough-in following Architect's directives to resolve conflicts.
4. Architectural Drawings govern.

B. Verify the physical dimension of each item of electrical equipment to fit the available space. Contractor's responsibility includes:
1. Coordination of the equipment to fit into the available space.
2. Access routes through the construction.

C. Layout Drawings:
1. Equipment arrangement shown on Drawings is diagrammatic to indicate general equipment sizing and spatial relationship. Include, as part of distribution equipment submittal, a scaled floor plan, which includes equipment shown with their submitted sizes. Include all feeder conduit routing, both aboveground and underground, including termination points at equipment. Submit for Engineer's review prior to commencing work.
2. Provide additional wiring details at switchboards, motor control centers, and other areas where work is of sufficient complexity to warrant additional detailing for coordination.
3. Submit layout drawings for approval prior to commencing field installation.

D. Where electrical connections are required for equipment provided as Work of other Divisions, coordinate rough in and wiring requirements for that equipment with its supplier and installer prior to commencing work. Notify Architect and Engineer of any discrepancies between the actual rough in and wiring requirements, and those identified on Drawings for resolution prior to installation.

E. Arrange raceways, wiring, and equipment to permit ready access to switches, motors, and control components.
1. Keep doors and access panels clear.

F. Coordinate electrical, telephone, and other utility services with the appropriate serving utility.
1. No additional compensation will be allowed the Contractor for connection fees or additional work or equipment required by the serving utility, but not covered in the Drawings or Specifications.

G. Coordinate underground work with other contractors working on the site.
1. Coordinate particularly with contractors installing storm sewer, sanitary sewer, water, and irrigation lines to avoid conflicts.
2. Common trenches may be used with other trades, providing clearances required by codes and ordinances are maintained.

H. Coordinated Shop Drawings.
1. Prepare in two-dimensional format.

2. Include but are not limited to:
    a. Beam penetration drawings indicating beam penetrations meeting the requirements indicated on the floor plans and on the structural drawings to a minimum of 1/4-inch equals 1-foot scale.
    b. Slab penetration drawings of HVAC, plumbing, sprinklers, lighting and electrical to a minimum of 1/4-inch equals 1-foot scale.

1.09 CHANGE ORDERS

A. Supplemental cost proposals by the Contractor accompanied with a complete itemized breakdown of labor and materials. At the Architect's request, make available estimating sheets for the supplemental cost proposals. Separate and allocate labor for each item of work.

1.10 WARRANTY

A. Provide a written warranty covering the work of this Division as required by the General Conditions.
    1. Incandescent Lamps: Excluded from this warranty.

B. Apparatus:
    1. Free of defects of material and workmanship and in accord with the Contract Documents.
    2. Built and installed to deliver its full rated capacity at the efficiency for which it was designed.
    3. Operate at full capacity without objectionable noise or vibration.

C. Include in Contractor's warranty for Work of Division 26, Electrical system damage caused by failures of any system component.

1.11 ALLOWANCES

A. Comply with Division 01, General Requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. Where specified materials or methods conflict with applicable codes, the more stringent requirement applies.

B. Provide apparatus built and installed to deliver its full rated capacity at the efficiency for which it was designed.

C. Ensure that entire electrical system operates at full capacity without objectionable noise or vibration.

D. Materials and Equipment:
    1. Use materials and equipment that are:
        a. New
        b. Quality meeting or exceeding specified standards.
        c. Free of faults and defects.
        d. Conforming to Contract Documents.
        e. Of size, make, type, and quality specified.
        f. Suitable for the installation indicated.
        g. Manufactured in accordance with NEMA, ANSI, UL, or other applicable standards.
        h. Otherwise as specified in Division 01, General Requirements.
    2. Equipment not meeting all requirements will not be acceptable, even though specified by name.
    3. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer.
        a. Component parts of the entire system need not be products of same manufacturer.
    4. Basis of Design:
        a. Consider the Basis of Design equipment scheduled or specified by performance or model number.

b. If other equipment is provided in lieu of the Basis of Design equipment, assume responsibility for all changes and costs which may be necessary to accommodate this equipment, including, but not limited to:
    1) Different sizes and locations for connections.
    2) Different dimensions.
    3) Different access requirements.
    4) Other differences.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:
    1. Provide a complete properly operating system for each item of equipment specified.
    2. Install materials in a neat and professional manner.
    3. Comply with equipment manufacturer's written instructions, the best industry practices, and the Contract Documents.
    4. Comply with latest published NECA Standard of Installation, and provide competent supervision.

B. Clarification:
    1. Where there is a conflict among manufacturer's instruction, best practice, and the Documents, request clarification from the Architect prior to rough-in.
    2. Architect's decision will be final.
    3. Remove and correct work installed without clarification at no cost to the Owner.

C. Existing concrete, block, or brick walls are considered not accessible and may require use of Surface Mounted Raceway (SMR) if existing concealed raceway and device boxes are not available for reuse or do not meet the intent of the design (i.e., proximity to egress path, point of use, etc.). Coordinate route and installation where SMR is required with the Architect/Engineer prior to rough-in. Responsible for reinstalling SMR routed without such prior approval to the Architect's satisfaction.

D. Existing stud walls (wood or metal) with or without blocking with plaster, plasterboard, or paneling finish are considered accessible with accessible ceiling, attic, tunnel, or crawl space above, below, or adjacent. Remove, patch, and repair finished surface as required to conceal rough in for new device locations. If it is determined that a specific instance will not permit concealment of rough-in due to obstructions such as beams, headers, and other structural elements, prior approval before rough-in from the Architect is required.

3.02 INSTALLATION IN RATED CONSTRUCTION

A. Install intumescent material around ducts, conduits, and other electrical elements penetrating rated construction.

B. Comply with firestop materials manufacturer written instructions to prevent spread of smoke or fire through sleeves or block-outs penetrating rated fire barriers.

C. Provide firestop materials specified in Division 07, and as follows:
    1. Capable of passing a 3-hour test per ASTM E-814 (UL 1479).
    2. Consisting of material capable of expanding nominally eight times when exposed to temperatures of 250 degrees F-350 degrees F.
    3. An alternate method utilizing intumescent materials in caulk or putty complying with Division 07, Thermal and Moisture Protection Section, "Through-Penetration Firestop Systems" may be used.

3.03 EXCAVATION AND BACKFILL

A. Perform all necessary excavation and backfill for the installation of electrical work in compliance with Division 31, Earthwork.

B. Direct Burial Cable or Non-Metallic Conduit:
    1. Minimum 3-inch cover of sand or clean earth fill placed around the cable or conduit on a leveled trench bottom.

2. Lay steel conduit on a smooth level trench bottom, so that contact is made for its entire length.
3. Where the electrical conduit is being laid, remove water from trench.

C. Place backfill in layers not exceeding 8-inches deep and compact to 95 percent of maximum density at optimum moisture to preclude settlement.
1. Interior: Bank sand or pea gravel.
2. Exterior: Excavated material with final 8-inches clean soil.

D. Following backfilling, grade all trenches to the level of surrounding soil. Dispose excess soil at the site as directed.

E. Provide 6-inches wide vinyl tape marked ELECTRICAL in backfill, 12-inches below finished grade, above all high voltage cable or conduit runs.

F. Coordinate patching of all asphalt or concrete surfaces disturbed by this work with General Contractor.

3.04 NOISE CONTROL

A. Minimize transmission of noise between occupied spaces.

B. Outlet Boxes:
1. Do not install outlet boxes on opposite sides of partitions back to back.
2. Do not use straight through outlet boxes, except where indicated.

C. Conduit:
1. Route conduit along corridors or other “noncritical” space to minimize penetrations through sound rated walls, or through non-sound-rated partitions between occupied spaces.
2. Grout solid and airtight all penetrations through sound rated partitions.
3. Use flexible connections or attachments between independent wall structures.
a. Do not rigidly connect (i.e., bridge) independent wall structures.

D. Do not install contactors, transformers, starters, and similar noise-producing devices on walls that are common to occupied spaces, unless otherwise indicated.
1. Where such devices are indicated to be mounted on walls common to occupied spaces, use shock mounts, or otherwise isolate them to prevent the transmission of noise to the occupied spaces.

E. Ballasts, contactors, starters, transformers, and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.

3.05 EQUIPMENT CONNECTIONS

A. General:
1. Provide complete electrical connections for all items of equipment requiring such connections, including incidental wiring, materials, devices, and labor necessary for a finished working installation.
2. Verify the location and method for connecting to each item of equipment prior to roughing-in.
3. Check the amperage, maximum overcurrent protection, voltage, phase, and similar attributes of each item of equipment before rough in and connection.

B. Motor Connections:
1. Make motor connections for the proper direction of rotation.
2. Minimum Size Flex for Mechanical Equipment: 1/2-inch; except at small control devices where 3/8-inch flex may be used.
3. Exposed Motor Wiring: Jacketed metallic flex with minimum 6-inches slack loop.
4. Do not test run pump motors until liquid is in the system.

C. Control devices and wiring relating to the HVAC systems are furnished and installed under Division 23, HVAC; except for provisions or items indicated in Division 26, Electrical Drawings and Specifications.

3.06 EQUIPMENT SUPPORT

A. Minimum Support Capacity:
   1. Provide fastening devices and supports for electrical equipment, luminaires, panels, outlets, and cabinets capable of supporting not less than four times the ultimate weight of the object or objects fastened to or suspended from the building structure.

B. Luminaire Supports:
   1. Support luminaires from the building structure.
   2. Use supports that provide proper alignment and leveling of luminaires.
   3. Where permitted at exposed luminaires, install flexible connections neat and straight, without excess slack, and attached to the support device.

C. Support all junction boxes, pull boxes, or other conduit terminating housings located above the suspended ceiling from the floor above, roof, or penthouse floor structure to prevent sagging or swaying.

D. Conduits:
   1. Support suspended conduits 1-inch and larger from the overhead structural system with metal ring or trapeze hangers and threaded steel rod having a safety factor of four.
   2. Conduits smaller than 1-inch installed in ceiling cavities, may be supported on the mechanical system supports when available space and support capacity has been coordinated with the subcontractor installing the supports.
   3. Anchor conduit installed in poured concrete to the steel reinforcing with No. 14 black iron wire.

E. Powder actuated or similar shot-in fastening devices will not be permitted for any electrical work except by special permission from the Architect.

3.07 ACCESS DOORS

A. Location and size of access doors is Work of Division 26, Electrical.

B. Furnishing and installation of access doors is work of Division 08, Openings.

3.08 ALIGNMENT

A. Install panels, cabinets, and equipment level and plumb, parallel with structural building lines.

B. Install distribution equipment and electrical enclosures fitted neatly, without gaps, openings, or distortion.

C. Properly and neatly, close unused openings with approved devices.

D. Fit surface panels, devices, and outlets with neat, appropriate, trims, plates, or covers without overhanging edges, protruding corners, or raw edges.

3.09 CUTTING AND PATCHING

A. General:
   1. Comply with Division 01, General Requirements.
   2. Restore to original condition new or existing work cut or damaged by installation, testing, and removal of electrical Work.
   3. Patch and finish spaces around conduits passing through floors and walls to match the adjacent construction, including painting or other finishes.
   4. Clean up and remove all dirt and debris.

B. Make additional required openings by drilling or cutting. Use of jackhammer is prohibited.

C. Cut oversize fill holes so that a tight fit is obtained around the objects passing through.
   1. In rated construction, comply with Division 07, Thermal and Moisture Protection.

D. Obtain Architect's permission and direction prior to piercing beams or columns.

E. Where alterations disturb lawns, paving, walks, and other permanent site improvements, repair and refinish surfaces to condition existing prior to commencement of work.

3.10 PROTECTION OF WORK

A. Protect electrical work and equipment installed under this Division against damage by other trades, weather conditions, or any other causes.
   1. Equipment found damaged or in other than new condition will be rejected as defective.

B. Keep switchgear, transformers, panels, luminaires, and electrical equipment covered or closed to exclude dust, dirt, and splashes of plaster, cement, paint, or other construction material spray.
   1. Equipment not free of contamination is not acceptable.

C. Provide enclosures and trims in new condition, free of rust, scratches, and other finish defects.
   1. If damaged, properly refinish in a manner acceptable to the Architect.

3.11 WIRING IN PRECAST CONSTRUCTION

A. Coordinate installation of electrical conduit, boxes, fittings, anchors, and miscellaneous items concealed in precast concrete assemblies with the General Contractor.

B. Where electrical items are required to be installed in concrete assemblies precast off-site, it will be the Electrical Contractor's responsibility to place the electrical items necessary in the concrete at the off-site locations or pay for the General Contractor to make arrangements for the installation of these items in the precast assemblies. Electrical Contractor held responsible for the proper placement and locations of electrical items at the off-site location.

3.12 COMPLETION AND TESTING

A. General:
   1. Comply with Division 01, General Requirements.

B. Upon completion, test systems to show that installed equipment operates as designed and specified, free of faults and unintentional grounds.
   1. Schedule system tests so that several occur on the same day.
   2. Coordinate testing schedule with construction phasing.
   3. Conduct tests in the presence of the Architect or its representative.
   4. Notify Architect of tests 48 hours in advance.

C. Engage a journeyman electrician with required tools to conduct equipment tests. Arrange to have the equipment factory representative present for those tests where the manufacturer's warranty could be impacted by the absence of a factory representative.

D. Perform tests per the requirements of each of the following systems:
   1. Low Voltage Distribution System
   2. Emergency Power System
   3. Standby Power System
   4. Fire Alarm System
   5. Lighting System
   6. Lighting Control System
   7. Power Metering and Monitoring System
   8. UPS System

E. Provide a written record of performance tests and submit with operation and maintenance

3.13 COMMISSIONING

A. Complete phases of work so the system, equipment, and components can be checked out, started, calibrated, operationally tested, adjusted, balanced, functionally tested, and otherwise commissioned. Complete systems, including subsystems, so they are fully functional.

B. Perform commissioning as specified in Section 01 9100, General Commissioning Requirements, the technical sections, and Section 26 0800, Commissioning of Electrical Systems.
   1. Unless specified otherwise in the technical sections, provide factory startup services for the following items of equipment:
      a. Transformers
      b. Primary Switchgear
      c. Secondary Switchgear
      d. Emergency Power Systems
      e. Electrical Distribution Systems
      f. Lighting Control Systems

C. Participation in Commissioning:
   1. Provide skilled technicians to checkout, startup, calibrate, and test systems, equipment, and components.
   2. The Engineer reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system.

D. Resolution of Deficiencies:
   1. Complete corrective work in a timely fashion to permit timely completion of the commissioning process. Experimentation to render system performance permitted.

E. Verification and Documentation:
   1. Once each test is performed, have the commissioning manager observe the physical responses of the system and compare them to the specified requirements to verify the test results.
   2. Submit site observation reports for deficiencies in the system.
   3. Record the result of individual checks or tests on the pre-approved checklist, test, and report form from the commissioning plan and submit results for review.

END OF SECTION

SECTION 26 0519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Conductors - 600V
   2. Power Limited Wiring
   3. Conductors - Fire Pump Circuits
   4. MC Branch Circuit Cable
   5. Connectors - 600V and Below

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0526, Grounding and Bonding for Electrical Systems

D. Section 26 0533, Raceways and Boxes for Electrical Systems

E. Section 26 0553, Identification for Electrical Systems

F. Section 26 0580, Electrical Testing

1.03 REFERENCED STANDARDS

A. ASTM: American Society for Testing and Materials:
   1. ASTM B 3 Soft or Annealed Copper Wire
   2. ASTM B 8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   3. ASTM B 33 Tinned Soft or Annealed Copper Wire for Electrical Purposes

B. ICEA: Insulated Cable Engineers Association:
   1. S-95-658 Non-shielded 0-2 kV Cables

C. IEEE: Institute of Electrical and Electronic Engineers:
   1. IEEE 383 Type Test of Class IE Electric Cables, Field Splices, and Connections

D. UL: Underwriters Laboratories:
   1. UL 44 Rubber-Insulated Wires and Cables
   1. UL 83 Thermoplastic-Insulated Wires and Cables
   2. UL 1277 Type TC Power and Control Tray Cable

1.04 SUBMITTALS

A. Submit product data for the following materials:
   1. Single conductor 600V power and control conductors.

B. Submittals of the following materials consist only of a listing of the manufacturer’s name and the applicable catalog numbers of the items to be utilized:
   1. Connectors
   2. Branch Circuit Conductor Splices
   3. Splices with Compression Fitting and Heat-Shrinkable Insulator

C. Submit cable test data per testing requirements of PART 3.

1.05 QUALITY ASSURANCE

A. Copper Conductors: Indicated sizes considered minimum for ampacities and voltage drop requirements.

B. Conductors for special systems as recommended by the equipment manufacturer except as noted.

C. Deliver conductors to the job site in cartons, protective covers, or on reels.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Conductors - 600V:
   1. General
   2. Essex
   3. Southwire
   4. Or approved equivalent.

B. MC Branch Circuit Cable:
   1. AFC Cable Systems
   2. Southwire
   3. Okonite

C. Connectors - 600V and Below:
   1. Burndy
   2. Anderson
   3. Or approved equivalent

2.02 CONDUCTORS – 600V

A. Type:
   1. Copper: 12 AWG minimum size unless noted otherwise. All conductors to be Class B concentric or compressed stranded.
   2. Aluminum: Not allowed.
   3. Conductors with continuous colored jackets are acceptable; refer to color-coding in PART 3.
   4. Conductors with manufacturers no lube continuous jacket coatings are acceptable.

B. Insulation:
   1. THHN/THWN-2

C. Through-wiring in fluorescent luminaires rated for 90 degree C minimum.

2.03 MC BRANCH CIRCUIT CABLE

A. Sheath:
   1. Steel or Aluminum, of the interlocking metal type, continuous and close fitting.
   2. Sheath not considered a current carrying or grounding conductor.

B. Conductors:
   1. Solid copper, of the same ampacity as the conduit/wire system indicated for the specific location.
   2. Provide separate green insulated grounding conductors in circuits where an isolated ground is called for.

C. Provide HCF rated cable for health care facility construction as code required.

D. Feeder style MC Cable with steel or aluminum armor for feeders greater than 100A.

E. Not permitted for homeruns back to branch panels.

F. Not permitted to be routed in wall cavities.

2.04 CONNECTORS – 600V AND BELOW

A. Branch Circuit Conductor Splices:
   1. Twist-on wire connectors: 3M Insulated Electrical Spring Connector (312/512), Ideal Industries Wing-Nut, or Buchanan B-Cap.

B. Cable Splices:
   1. Compression tool applied sleeves, Kearney, Burndy, or equivalent with 600V heat shrink insulation.
   2. Submit proposed splice location to the Engineer for review, except where indicated on the plans

C. Terminator Lugs for Stranded Wire:
   1. 10 AWG Wire and Smaller: Spade flared, tool applied.
   2. 8 AWG Wire and Larger: Compression tool applied.
   3. Setscrew type terminator lugs furnished as an integral part of distribution equipment, switches and circuit breakers will be acceptable.

PART 3 EXECUTION

3.01 CONDUCTORS

A. Pulling compounds may be used for pulling conductors. Clean residue from the conductors and raceway entrances after the pull is made.

B. Pulleys or Blocks:
   1. Use for alignment of the conductors when pulling.
   2. Pulling in accordance with manufacturer's specifications regarding pulling tensions, bending radii of the cable, and compounds.

C. Make up and insulate wiring promptly after installation of conductors. Do not pull wire in until bushings are installed and raceways terminations are completed. Do not pull wire into conduit embedded in concrete until after the concrete poured and forms stripped.

D. Provide a dedicated neutral conductor with each branch circuit, do not use a shared neutral conductor between phases unless specifically requested or directed.

3.02 CONNECTORS

A. Terminate control and special systems with a tool applied spade flared lug when terminating at a screw connection.

B. Screw and bolt type connectors made up tight and retightened after an 8-hour period.

C. Apply tool applied compression connectors per manufacturer's recommendations and physically checked for tightness.

3.03 COLOR CODING

A. Color code secondary service, feeders, and branch circuit conductors. Phase color code to be consistent at feeder terminations, A-B-C left-to-right, A-B-C top-to-bottom, or A-B-C front-to-back. Color code is as follows:

120/240V 208Y/120V	Phase	480V 480Y/277V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray*
Green	Ground**	Green
Pink or Tan	Switchlegs	Pink or Tan
Purple	Travelers	Purple
Red	Fire Alarm	Red
* or white with colored (other than green) tracer		
**Ground for isolated ground receptacles green with yellow tracer.		

B. Use solid color compound or solid color coating for 12 AWG and 10 AWG branch circuit conductors and neutral sizes.

C. Phase conductors 8 AWG and larger color code using one of the following:
   1. Solid color compound or solid color coating.
   2. Stripes, bands, or hash marks of color specified above.
   3. Colored as specified using 3/4-inch wide tape. Apply tape in half overlapping turns for a minimum of three inches for terminal points and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Apply tags to cable stating size and insulation type where cable markings are tape covered.

D. Switch legs, travelers, etc., consistent with the phases to which, connected or a color distinctive from that listed.

E. Color-coding of the flexible wiring system conductors and connectors.

F. For modifications and additions to existing wiring systems, conform color-coding to the existing wiring system.

3.04 FIELD TESTING

A. 600V Rated Conductors: Test for continuity. Conductors 100A and over in meggered after installation and prior to termination. Provide the megger, rated 1,000V DC, and record and maintain the results, in tabular form, clearly identifying each conductor tested.

1. Replace cables when test value is less than 1 megohms.
2. Cable test submittal include results, equipment used, and date.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Ground Conductors
   2. Connectors
   3. Ground Pads
   4. Ground Rods

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0533, Raceways and Boxes for Electrical Systems

E. Section 26 0580, Electrical Testing

F. Section 26 2200, Low Voltage Transformers

G. Section 26 2413, Switchboards

H. Section 26 2416, Panelboards

I. Section 26 2726, Wiring Devices

J. Section 26 2900, Motor Controllers

1.03 QUALITY ASSURANCE

A. Provide complete ground systems as indicated. Include conduit system, transformer housings, switchboard frame and neutral bus, motors, and miscellaneous grounds required.

B. Provide 600V insulated main bonding jumper for utility company connection between ground bus in switchgear lineup and ground termination point or service ground in transformer vault as directed by the utility.

C. Provide an insulated ground conductor in every conduit or raceway containing power conductors.

PART 2 PRODUCTS

2.01 GROUND CONDUCTORS

A. Green insulated copper for use in conduits, raceways, and enclosures.

B. Bare copper for ground grids and grounding electrode systems.

2.02 CONNECTORS

A. Cast, set screw, or bolted type.

B. Form poured, exothermic welds.

C. Grounding lugs where provided as standard manufacturer’s items on equipment.

2.03 GROUND PADS

A. Provide a ground pad at each location shown on the Drawings. 1000A rated copper bus nominally 1/4-inch by 4-inch by 12-inch long or as shown on the plans.

B. Provide 1/4-inch and 1/2-inch bolt holes per ANSI TIA/EIA 607 standards for telecom ground bars.

C. Mount ground pads with standoff devices to provide a minimum of 1-1/2 inches free space behind pad for access to lug nuts and washers.

2.04 GROUND RODS

A. Copper-Bonded steel, 5/8-inch by 10-feet long ground rods. Where ground wells are indicated, provide a 12-inch deep, 8-inch diameter precast concrete well with flush lid for accessibility and inspection of welded connections, RCP Vaults 12R12A with 12R12-t cover.

PART 3 EXECUTION

3.01 INSTALLATION

A. Grounding Conductors: Sized in accordance with Article 250, Tables 250.66 and 250.122 of the National Electrical Code.

B. Grounding Conductor Connectors: Make up tight, located for future servicing, and ensure low impedance.

C. Ground the electrical system, the cold-water service, structural steel, and transformers to the building ground grid.

D. Plug-in Receptacles: Bonded to the boxes, raceways, and grounding conductor.

3.02 GROUND RING

A. Provide exterior ground ring/ground grid as indicated, with pigtails for extension as indicated. Exothermic weld connections.

3.03 UFER GROUND

A. Provide a concrete encased building grounding electrode where shown on the Drawings. Grounding electrode consist of a minimum of 20-feet of AWG 4 bare copper conductor cast into the bottom 6-inches of an exterior concrete foundation or footing.

3.04 EQUIPMENT

A. Provide separate green insulated equipment ground conductor in non-metallic and flexible electrical raceways.

B. Ground luminaires, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, buses, etc., for this purpose.

C. Provide grounding bushings on feeder conduit entrances to panels and equipment enclosures and bond bushings to enclosures with minimum 10 AWG conductor. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through 10 AWG.

3.05 GROUND PADS

A. Drill ground pads as necessary for attachment of grounding conductors as required.

B. Utilize 2-hole lugs for terminating 4/0 AWG and larger ground conductors.

C. Bond ground pads to adjacent structural steel with 4/0 bare copper cable, using form poured exothermic welds.

3.06 GROUND RESISTANCE TEST

A. Accomplish with a ground resistance direct-reading single test meter utilizing the Fall-of-Potential method and two reference electrodes. Perform test prior to interconnection to other grounding systems. Orient the concrete-encased ground electrode to be tested and the two reference electrodes in straight-line spaced 50-feet apart. Drive the two reference electrodes 5-feet deep.

B. Provide test results writing.
   1. Show temperature, humidity, and condition of the soil at the time of the tests.
   2. Where the ground resistance exceeds 5 Ohms, the Engineer will issue additional instructions.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Hangers
   2. Pipe Straps
   3. Support of Open Cabling
   4. Rooftop Conduit Supports

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0533, Raceways and Boxes for Electrical Systems

D. Section 26 0536, Cable Trays for Electrical Systems

E. Section 26 2200, Low Voltage Transformers

F. Section 26 2413, Switchboards

G. Section 26 2416, Panelboards

H. Section 26 5000, Lighting

1.03 REFERENCED STANDARDS

A. International Building Code (IBC)

B. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

PART 2 PRODUCTS

2.01 HANGERS

A. Kindorf B-905-2A Channel, H-119-D washer, C105 strap, minimum 1/2-inch rod with ceiling flange, or approved equal.

2.02 PIPE STRAPS

A. Two-hole galvanized or malleable iron.

2.03 SUPPORT OF OPEN CABLING

A. Support of Open Cabling: Label NRTL for support of Category 16 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
   1. Support brackets with cable tie slots for fastening cable ties to brackets.
   2. Lacing bars, spools, J-hooks, and D-rings.
   3. Straps and other devices.

2.04 ROOFTOP CONDUIT SUPPORTS

A. Manufacturer:
   1. Cooper B-Line Dura-Blok Rooftop Supports
   2. Erico
   3. Or approved equal.

B. Curb base made of 100 percent recycled rubber and polyurethane prepolymer with a uniform load.

C. Capacity of 500 pounds per linear foot of support.

D. UV Resistant.

E. Steel frame: 14 gauge galvanized strut per ASTM A653 or 12 gauge galvanized strut per ASTM A653 for bridge series.

F. Continuous block channel supports with 1-inch gaps to allow water flow, bridge change supports, extendable height channel supports, and elevated single conduit supports.

G. Attaching hardware: Zinc plated threaded rod, nuts and attaching hardware per ASTM B633 fastened directly into rubber material with weather resistant Type 12 lag screws.

H. Provide load distribution plates as required for concentrated loads.

I. Finish: Black

J. Provide hot dipped galvanized components where exposed to weather.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide electrical equipment supports.

B. Install vertical support members for equipment, straight and parallel to building walls.

C. Provide independent supports to structural member for electrical fixtures, materials, or equipment installed in or on ceiling, walls, or in void spaces and/or over furred or suspended ceilings.

D. Do not use other trades' fastening devices to support electrical equipment materials or fixtures.

E. Do not use supports and/or fastening devices to support other than one particular item.

F. Support conduits within 18-inches of outlets, boxes, panels, cabinets, and deflections.

G. Provide complete seismic anchorage and bracing for the vertical and lateral restraint of conduit, cable trays, bus ducts, and electrical equipment as required by IBC Chapter 6 and the most recent version of the SMACNA Seismic Restraint Manual for Seismic Hazard Level (SHL) A.

H. Submit shop drawings of bracing systems to the Architect for review and bear the seal of a professional engineer registered in the State the project is located.

3.02 LUMINAIRES

A. Light-Duty Ceiling Systems:
   1. Attach 12 gauge hanger wire from each corner of the luminaire to the structure above.
   2. Positively and securely, attach luminaire within 6-inches of each corner to the suspended ceiling-framing member by mechanical means.

B. Intermediate-Duty Ceiling Systems:
   1. Positively and securely, attach luminaire within 6-inches of each corner to the suspended ceiling-framing member by mechanical means.
   2. Attach 12 gauge hanger wire within 3-inches of each corner of each luminaire.
   3. Connect two 12 gauge slack wires from the luminaire housing to the structure above for luminaires weighing less than 56 pounds.
   4. Support luminaries weighing 56 pounds or more directly from the structure above with approved hangers attached to each corner of the luminaire.

C. Heavy-Duty Ceiling Systems:
   1. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling-framing member by mechanical means.
   2. Connect two 12-gauge slack wires from the luminaire housing to the structure above for luminaires weighing less than 56 pounds.
   3. Support luminaries weighing 56 pounds or more directly from the structure above with approved hangers attached to each corner of the luminaire.

3.03 PULL AND JUNCTION BOXES

A. Pull and junction boxes installed within the cavity of a suspended ceiling that is not a fire rated assembly may be attached to the suspended ceiling framing members, provided the following criteria are met:
   1. Installation complies with the ceiling system manufacturer's instructions.
   2. Pull or junction box is not larger than 100 cubic inches.

3. Support to the main runner with two fastening devices designed for framing member application and positively attach or lock to the member.
4. Serves branch circuits and associated equipment in the area.
5. Pull or junction box is within 6-feet of the luminaires supplied.
6. Framing members are not rotated more than 2 degrees after installation.
7. Install within the cavity of a suspended ceiling may be attached to independent support wires, provided the following criteria are met:
    a. Independent support wires are taut and connected at both ends, one end to the ceiling framing member and the other to the structure above.
    b. Not larger than 100 cubic inches.
    c. Secure to the independent support wires by two fastening devices designed for the application.
    d. Independent support wires in a fire-rated ceiling are distinguishable by color, tagging, or other effective means.

3.04 CABLES AND RACEWAY

A. Cables and raceway installed within the cavity of a suspended ceiling may be attached to independent support wires provided the following criteria are met:
    1. Independent support wires are taut and connected at both ends, one end to the ceiling framing member and the other to the structure above.
    2. Raceways no larger than 1-inch trade size and cables and bundled cables are not larger than 1-inch diameter including insulation.
    3. Not more than three raceways or cables supported by independent support wire and supported within the top or bottom 12-inches.
    4. Cables for telecommunications, data processing, Class 2 power-limited signaling systems, fiber optics, and other power limited systems are securely fastened within 2 feet of each termination and at intervals not to exceed 5-feet or per the manufacturer's installation instructions.
    5. Secure raceways at intervals required for the type of raceway installed.
    6. Secure cables and raceway to independent support wires by fastening devices and clips designed for the purpose.
    7. Independent support wires are distinguishable by color, tagging, or other effective means.

B. Cables and raceway installed within the cavity of a suspended ceiling may be supported with trapezes constructed of steel rods and channels provided the following criteria are met:
    1. The size of the rods, channel, and fastening devices are suitable for the anticipated weight.
    2. The spacing of the trapezes meets that required for the type of raceway installed.
    3. Secure to a trapeze by straps designed for the purpose.
    4. Cables and raceway do not support other raceway or cables.
    5. An appropriately sized seismic bracing system is installed.

3.05 ROOFTOP CONDUIT SUPPORTS

A. Coordinate with roofing manufacturer for roof membrane compression capacities. Provide a compatible sheet of roofing material under each support to disperse concentrated loads and provide added membrane protection. Do not use supports that will void roofing warranty,

B. Install in accordance with recommendations and instructions provided by manufacturer.

C. Provide supports such that rooftop raceways are a minimum of 4-inches above roof.

END OF SECTION

SECTION 26 0533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Metallic Conduits
   2. Non-Metallic Conduits
   3. Wireways
   4. Fittings
   5. Metallic Boxes
   6. Non-Metallic Boxes

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0529, Hangers and Supports for Electrical Systems

F. Section 26 0553, Identification for Electrical Systems

PART 2 PRODUCTS

2.01 GENERAL

A. Raceways and conduits of specified types for electrical system wiring, except where clearly indicated otherwise.

B. Fittings, boxes, hangers, and appurtenances required for the conduits and raceways.

C. Size raceways and conduits as indicated. Where no size indicated, conduit may be the minimum code permitted size for the quantity of conductors installed, based upon NEC tables for conductors with type THW insulation.

2.02 METALLIC CONDUITS

A. Rigid Metal Conduit (RMC):
   1. Smooth surfaced, heavy wall mild steel tube of uniform thickness and temper, reamed and threaded at each end and protected inside and out with galvanizing, sherardizing, or equivalent process.
   2. Comply with NEC Article 344.

B. Electrical Metallic Tubing (EMT):
   1. Smooth surface, thin wall mild steel tube of uniform thickness and temper, galvanized or sherardized on the outside, and enameled on the interior.
   2. Comply with NEC Article 358.

C. Flexible Conduits (Flex):
   1. Flexible Metallic Conduit:
      a. Interlocking single strip steel construction, galvanized inside and out after fabrication.
      b. Comply with NEC Article 348.
   2. Liquid Tight:
      a. Similar to flexible metallic conduit, except encased in a liquid tight polyvinylchloride or equivalent outer jacket over the flexible steel core.
      b. Comply with NEC Article 350.

2.03 NON-METALLIC CONDUITS

A. Rigid Non-Metallic Conduit:
   1. Type II PVC Schedule 40 or 80, suitable for use with 90 degree C rated wire.

2. Conform to UL Standard 65l and carry appropriate UL listing for above and below ground use.
3. Comply with NEC Article 352.

2.04 WIREWAYS

A. Troughs: Steel, painted, square in cross section, preformed knockouts on standard spacing, screw cover.

B. Fittings: Tees, elbows, couplings as required for configuration shown on the Drawings.

2.05 FITTINGS

A. RMC:
1. Threaded Locknuts: Sealing type where used with NEMA 2, 3, 3R, 4, and 12 enclosures.
2. Threaded Bushings: 1-1/4-inch and larger, insulated, grounding type as required under Section 26 0526, Grounding and Bonding for Electrical Systems.
3. Threaded Couplings:
   a. Standard threaded of the same material and as furnished with conduit supplied.
   b. Erickson type couplings may be used where required to complete conduit runs larger than 1-inch.

B. EMT:
1. Connectors:
   a. Steel compression ring or steel set screw type for conduit termination, with insulated throat, suitable for conditions used.
   b. Use lay-in grounding type bushings where terminating grounding conductors.
2. Couplings: Steel compression ring or steel set screw type, concrete tight.

C. Threadless: RMC couplings and box connectors may be steel threadless, compression ring or set screw type for use with conduits 1-inch and smaller where installed in poured concrete locations or where limited working space makes threaded fittings impractical.

D. Weatherproof Connectors: Threaded

E. Expansion Couplings: Equivalent to O.Z. type EX with jumper.

F. Seal-Offs: With filler fiber, compound, and removable cover.

2.06 METALLIC BOXES

A. Flush and Concealed Outlet Boxes: Galvanized stamped steel with screw ears for device ring mounting, knock-out plugs, mounting holes, fixture studs if required, RACO or equivalent.

B. Surface Outlet Boxes: Galvanized stamped steel same as above for use on ceilings; cast steel or aluminum with threaded hubs or bosses for use on walls.

C. Large Boxes:
1. Boxes exceeding 4-11/16-inches when required welded steel construction with screw cover and painted, steel gauge as required by physical size.
2. Manufacturers:
   a. Hoffman
   b. Circle AW
   c. Or equivalent.

D. Systems:
1. Boxes for systems devices as recommended by the systems manufacturer, suitable for the equipment installed.
2. Equip with grounding lugs, brackets, device rings, etc., as required.

2.07 NON-METALLIC BOXES

A. PVC, molded enclosures, threaded hubs.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conceal conduits in finished spaces. Concealed conduits run in a direct line with long sweep bends and offsets. Where RMC embedded is in concrete below grade or in damp locations make watertight by painting the entire male thread with Rustoleum metal primer or equivalent before assembly.

B. Route exposed conduit parallel or at right angles to structural building lines and neatly offset into boxes. Conduits attached directly to building surfaces closely follow the surfaces. Conduit fittings used to saddle under beams. Coordinate drilling or notching of existing beams, trusses on structural members with Architect prior to commencing.

C. Rigidly secure RMC terminations at boxes, cabinets, and general wiring enclosures with double locknuts and bushings or approved fittings. Screw in conduit and engage at least five threads in hub where conduit boxes with threaded hubs or bosses are used. Use insulating bushings for conduits 1-1/4-inches or larger.

D. Keep conduit and raceways closed with suitable plugs or caps during construction to prevent entrance of dirt, moisture, concrete, or foreign objects. Clean and dry raceways before installation of wire and at the time of acceptance.

E. Pack spaces around conduits with polyethylene backing rods and seal with polyurethane caulking to prevent entrance of moisture where conduits are installed in sleeves or block-outs penetrating moisture barriers.

3.02 CONDUIT

A. RMC:
   1. Use in all areas for wiring systems.
   2. Install for exposed runs of medium voltage circuits outside of the electrical rooms.
   3. Install where subject to mechanical injury.
   4. Install with threaded fittings made up tight.

B. EMT:
   1. Securely support and fasten whether exposed or concealed at intervals of nominally every 8-feet and within 24-inches of each outlet, ell, fitting, panel, etc.
   2. Use in other dry protected locations for circuits rated 600V and less.
      a. Exceptions:
         1) Acceptable for outdoor use in photovoltaic roof applications, and within PV racking areas where not subject to damage.
         2) Acceptable for use in covered parking garages and other covered, protected areas, where periodically indirectly exposed to exterior weather conditions.
         3) Use raintight compression fittings where exposed to outdoor conditions.
   3. Do not install in areas where exposed to damage, such as vehicular or pedestrian.

C. Flex:
   1. Use for connections to vibration producing equipment and where installation flexibility is required with a minimum 12-inches slack connection.
   2. Limit flex length to 36-inches for exposed equipment connections and 72-inches in concealed ceiling and wall cavities.
   3. Use PVC jacketed flex in wet locations, areas subject to washdown, and exterior locations.

D. PVC:
   1. Type II Schedule 40 and 80 PVC may be used underground and in and under interior slabs, poured concrete walls, and where scheduled or noted on the Drawings.
   2. Make connections with waterproof solvent cement.
   3. Provide RMC at 60 degree and larger bends and where penetrating slabs.

3.03 RACEWAYS

A. Surface metal wireways may be installed at locations to serve motor starters or other control devices where required by a multitude of wiring interconnections or physical layout.

3.04 FITTINGS

A. Assemble continuous and secured metallic raceways and conduits to boxes, panels, etc., with appropriate fittings to maintain electrical continuity. Cut square and reamed smooth conduit joints with fittings drawn up tight.

B. Do not use Crimp-on, tap-on, indenter type, malleable iron, or cast set screw fittings.

3.05 BOXES

A. General:
   1. Outlet Boxes: Code required size to accommodate wires, fittings, and devices.
   2. Provide multi-gang boxes as required to accept devices installed with no more than one device per gang.
   3. Equip metallic boxes with grounding provisions.

B. Size and Type:
   1. Flush wall switch and receptacle outlets used with conduit systems 4-inches square, 1-1/2-inches or deeper, with one or two-gang plaster ring, mounted vertically. Where three or more devices are at one location, use one piece multiple gang tile box or gang box with suitable device ring.
   2. Wall bracket and ceiling surface mounted luminaire outlets 4-inch octagon 1-1/2-inches deep with 3/8-inch fixture stud where required. Wall bracket outlets have single gang opening where required to accommodate luminaire canopy. Provide larger boxes or extension rings where quantity of wires installed requires more cubic capacity.
   3. Junction boxes installed in accessible ceiling or wall cavities or exposed in utility areas minimum of 4-inches square, 1-1/2 inches deep with appropriately marked blank cover.
   4. Boxes for the special systems suitable for the equipment installed. Coordinate size and type with the system supplier.

C. Pull Boxes:
   1. Provide pull boxes where shown for installation of cable supports or where required to limit the number of bends in conduits to not more than three 90-degree bends.
   2. Use galvanized boxes of code-required size with removable covers installed so that covers will be accessible after work is completed.

D. Installation:
   1. Mount boxes and outlets at nominal centerline heights shown on the drawings.
   2. Adjust heights in concrete masonry unit (CMU) walls to prevent devices or finish plates from spanning masonry joints.
   3. Recessed Boxes:
      a. Flush with finished surfaces or not more than 1/8-inch back, level and plumb.
      b. Long screws with spacers or shims for mounting devices will not be acceptable.
      c. No combustible material exposed to wiring at outlets.
   4. Covers for flush mounted boxes in finished spaces extend a minimum of 1/4-inch beyond the box edge to provide a finished appearance. Finish edge of cover to match cover face.
   5. Boxes installed attached to a stud in sheet rock walls equipped with opposite side box supports equivalent to Caddy 760. Install drywall screw prior to finish taping. Methods used to attach boxes to studs not to cause projections on the face of the stud to prevent full-length contact of sheet rock to the stud face.

3.06 PULL WIRES

A. Install nylon pull lines in empty conduits larger than 1-inch where routing includes 25-feet or more in length or includes 180 degrees or more in bends.

B. Where conduits requiring pull lines are stubbed out and capped, coil a minimum of 36-inches of pull line and tape at termination of conduit for easy future access. Label pull lines as to conduit starting or terminations point and intended future use.

END OF SECTION

SECTION 26 0543

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. The Sections includes:
   1. Precast Concrete Handholes and Boxes
   2. Duct Lines
   3. Spacers

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Division 31, Earthwork

1.03 REFERENCED STANDARDS

A. References listed below:

1.	AASHTO	American Association of State Highway and Transportation Officials
2.	ACI	American Concrete Institute
3.	ANSI	American National Standards Institute
4.	ASTM	American Society for Testing and Materials
5.	NEC	National Electrical Code
6.	NEMA	National Electrical Manufacturers Association
7.	UL	Underwriters Laboratories

1.04 SUBMITTALS

A. Shop Drawings:
   1. Submit descriptive details of the manufacturers' proposed standard product listings, including:
      a. Precast handholes.
      b. Precast handhole accessories, including covers and frames.
      c. Precast concrete 28-day compressive strength data.
      d. Handhole cement certification.
      e. Duct spacers.
      f. Ducts and raceways.

B. Show drawings for handholes, including:
   1. Design criteria signed by professional structural engineer licensed by the State of Oregon.
   2. Reinforcing steel locations and concrete covers.
   3. Layout of inserts, attachments, and openings.
   4. Locations and types of joints.
   5. Accessories, including covers, frames, and diamond plate doors where applicable.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE HANDHOLES AND BOXES

A. Handholes and Boxes:
   1. Precast concrete, 4,000 psi strength at 28 days, with reinforcing and galvanized checker plate traffic covers designed for AASHTO loading of H-20.
   2. Wall thickness 3-inches minimum.

B. Precast Units:
   1. Conform to ASTM C 478.
   2. Size, plan area and clear height not less than shown on the drawings and have concrete slab bottoms with sumps.

C. Pulling Irons: 7/8-inch diameter hot-dip galvanized steel bar with exposed triangular opening.

D. Design:
   1. Precast structures shall be designed in accordance with AASHTO Specification for Highway Bridges. Concrete and reinforcing shall be designed in accordance with ACI 318.
   2. Tops and walls of structures designed for AASHTO H-20 highway loading, with 30 percent loading added for impact.
   3. Design walls to withstand soil pressures, taking into consideration the soil to be encountered and ground water level present at the site.
   4. Assume ground water level is at ground surface unless a lower water table is indicated in the boring logs. Design and construct precast handhole pull boxes not to float.

E. Identify structures with manufacturer's name embedded in, or otherwise permanently attached to, an interior wall face.

F. Covers for handholes and boxes spring-assisted galvanized diamond plate door with locking latch, 3-inch high markings in weld bead, inscribed before galvanizing with the word, ELECTRICAL, COMMUNICATION, or DATA. Identify the covers.

G. Acceptable Manufacturers:
   1. Utility Vault Company
   2. Hanson
   3. Renton Concrete Products
   4. Or equal.

2.02 DUCT LINES

A. Size: Except where otherwise shown on the drawings, ducts and conduits shall not be less than 4-inch trade size.

B. Ducts (Direct-Buried):
   1. Rigid Non-Metallic Conduit:
      a. Type II PVC Schedule 40, suitable for use with 90 degree C rated wire.
      b. Conduit conforms to UL Standard 651 and carry appropriate UL listing for above- and below-ground use.
   2. Rigid Metal Conduit:
      a. UL 6 galvanized rigid steel.
      b. Where metal conduit is shown on the drawings or specified below, conduit has a coating of 20 mil bonded PVC, or coated with bituminous asphaltic compound.

C. Manufactured bends shall be not less than 36-inches in radius for conduits 4-inches in diameter or larger.

2.03 SPACERS

A. Factory-fabricated rigid PVC vertical and horizontal interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum of 3-inches separation between ducts while supporting ducts during concreting or backfilling.

B. Manufacturers:
   1. Carlon
   2. Orangeburg
   3. Or equal.

PART 3 EXECUTION

3.01 PRECAST MANHOLES AND HANDHOLE PULL BOXES

A. Construction
   1. Units may be precast monolithically or may consist of assembled sections.
   2. Assembled sections shall have mating edges with tongue-and-groove joints. Joints shall be designed to firmly interlock adjoining components, and provide waterproof junctions. Joints shall be sealed watertight using preformed plastic strips installed in accordance with the manufacturer's instructions.

3. Furnish lifting devices for proper handling of units.
4. Provide ground rod and sleeve in manhole floors.
5. Install sump with grate.

B. Duct entries shall be a minimum of 14-inches above floor and below ceiling.

C. Provide cable supports, clamps, or racks.

D. Floor slope 2 percent in all directions to a sump.

E. Sump a minimum of 8-inches in diameter.

F. Install pulling irons or inserts for pulling eyes, inserts for cable racks, and openings for conduit entry as required. Steel components other than reinforced steel shall be hot-dip galvanized after fabrication. Manholes and handhole pull boxes shall have concrete bottoms.

G. Install drains in electrical manholes and handhole pull boxes with a minimum 4-inch pipe set in the bottom and terminated in a minimum of 1 cubic yard of drain rock.

H. Manholes and handhole pull boxes specifically noted on the drawings shall be drained into the storm water system. Seal vault watertight and drain coordinated with raceway entries.

3.02 TRENCHING

A. Excavate trenches in accordance with Division 31, Earthwork.

B. Work with extreme care near existing utilities to avoid damaging them. Cut the trenches neatly and uniformly.

3.03 DUCT LINE INSTALLATIONS

A. General:
1. Duct line in accordance with the NEC, as shown on the drawings, and as specified.
2. Slope duct to drain away from building and equipment entrances. Pitch not less than 4-inches in 100-feet. Curved sections in duct lines consist of long sweep bends with a minimum radius of 5-feet in the horizontal and vertical directions unless noted otherwise. Use of manufactured bends is limited to building entrances and stub-ups to equipment.
3. Underground conduit stub-ups to equipment inside buildings shall be galvanized rigid steel and shall extend at least 10-feet outside the building foundation. Stub-ups to equipment, mounted on outdoor concrete slabs, shall be galvanized rigid steel and shall extend at least 5-feet from edge of slab. Install insulated grounding bushings on the terminations. Couple the steel conduits to the ducts with suitable adapters, and encase with 3-inches of concrete.
4. Upon completion of the duct bank installation, pull a standard flexible mandrel through each duct. The mandrel shall be at least 12-inches long, and shall have a diameter 1/2-inch less than the inside diameter of the duct. After mandrelling, pull a brush with stiff bristles through each duct to remove the loosened particles. Diameter of the brush equal to or slightly larger than the diameter of the duct.
5. Seal the ducts and conduits at building entrances and at outdoor equipment terminations with a suitable non-hardening compound.

B. Direct Burial Duct and Conduits:
1. Install direct burial ducts and conduits only where shown on the drawings.
2. Join and terminate ducts and conduits with fittings recommended by the conduit manufacturer.
3. Tops of ducts and conduits not less than 24-inches below grade.
4. Do not kink the ducts or conduits.
5. Place a continuous strip of utility warning tape approximately 12-inches above ducts or conduits before backfilling trenches. Refer to Division 31, Earthwork, for tape description and installation requirements.

END OF SECTION

SECTION 26 0545

SEISMIC RESTRAINTS FOR ELECTRICAL RACEWAYS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Seismic Bracing
   2. Channel Type Elements
   3. Bolting Accessories

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0529, Hangers and Supports for Electrical Systems

1.03 REFERENCED STANDARDS

A. The following are the referenced standards:

1.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
2.	AISC	American Institute of Steel Construction
3.	ASTM	American Society for Testing and Materials
4.	AWS	American Welding Society
5.	IBC	International Building Code
6.	ICC	International Code Council
7.	OSHPD	Office of Statewide Health Planning and Development
8.	ASCE 7-16	Minimum Design Loads and Associated Criteria for Buildings and Other Structures

1.04 QUALITY ASSURANCE

A. General Requirements:
   1. Provide seismic restraints for equipment, both supported and suspended, conduits, and cable tray systems.
   2. Bracing of conduits and cable trays in accordance with the provisions set forth in the SMACNA seismic restraint manual and the requirements set in ASCE 7 Section 13.2.
   3. Review and approve structural requirements for restraints, including their attachment to the building structure by a registered structural engineer in the same state as the project.
   4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.

B. Bracing of Conduits:
   1. Provide seismic bracing of conduit as detailed below:
      a. Brace electrical conduits 2-1/2-inch nominal diameter or larger.
      b. Brace conduits located in electrical rooms, boiler rooms, mechanical equipment rooms, and refrigeration mechanical rooms that are 1-1/4-inch nominal diameter and larger.
      c. Exception: Conduits suspended by individual hangers 12-inches or less in length, as measured from the top of the conduit to the bottom of the support where the hanger is attached, need not be braced.

C. Suspended Equipment and Raceways:
   1. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable with an added nut and neoprene and steel washer.
   2. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and are to be indicated in the shop drawings.
   3. Provide detailed shop drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

D. Seismic restraints, including anchors to building structure, designed by a registered professional structural engineer licensed in the state of Oregon. Design includes:
   1. Number, size, capacity, and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. For units weighing greater than 2500 pounds, or curbs more than 10 feet long, provide substantiating calculations the curb can accept the prescribed seismic forces.
   2. Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations, test data, or California OSHPD approval number verifying the horizontal and vertical ratings of the seismic restraint devices.
   3. Number, size, capacity, and location of braces and anchors for suspended raceways, bus ducts, and cable trays on as-built plan drawings.
      a. Select a single seismic restraint system pre-designed to meet the requirements of the latest edition of the IBC such as the 1999 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, and Electrical Systems.
      b. Details or designs from separate seismic restraint guidelines are not acceptable. Installation not addressed by the selected system shall be designed, detailed, and submitted alone with the as-built plan drawings.
      c. Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional structural engineer licensed in the state of Oregon who designed the layout of the braces.

E. Supports, Hangers, and Anchors: Comply with the requirements of Section 26 0529, Hangers and Supports for Electrical Systems meet the requirements of ASCE 7 Section 13.2 based on the Seismic Design Criteria located on the structural drawings.

1.05 SUBMITTALS

A. Product Data: Submit product data for products specified herein.

B. Shop Drawings:
   1. Submit shop drawings complying with the requirements of the Quality Assurance article of this Section.
   2. Stamp shop drawings by a professional structural engineer licensed in the state of Oregon.
   3. Approve submittals prior to rack fabrication and installation.

C. Calculations:
   1. Submit seismic calculations indicating restraint loadings resulting from the design seismic forces presented in the Quality Assurance article of this Section.
   2. Include anchorage details that include the diameter, embedment, and material grade of the material in which the anchor is placed.
   3. Stamped by a professional structural engineer licensed in the state of Oregon.

D. Certifications:
   1. Submit certification of seismic restraint's and building structural member's capability to safely accept loads resulting from seismic forces calculated in the previous paragraph.
   2. Tests in three planes clearly showing ultimate strength and appropriate safety factors performed by independent laboratories and certified by a professional structural engineer licensed in the state of Oregon or calculations by a professional structural engineer licensed in the state of Oregon are acceptable.

PART 2 PRODUCTS

2.01 SEISMIC BRACING:

A. Steel fabrication, in accordance with AISC Steel Manual, with structural steel shapes of ASTM A 36 steel.

B. Welding in accordance with AWS D1.1.

C. Design and sizes as required.

D. Fastenings, bracing, and assembly selected by a professional structural engineer licensed in the state of Oregon.

E. Show that the maximum stress in any structural steel member will not exceed 18,000 psi.

2.02 CHANNEL TYPE ELEMENTS

A. 12 gauge formed steel, 1-5/8-inch square prime painted or chromate dip finish. Use spring-in nuts with grooves.

2.03 BOLTING ACCESSORIES

A. Machine bolts with semi-finished nuts.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide support assemblies to meet the seismic zone indicated. Equipment shall be braced and anchored to conform to the requirements listed under the Quality Assurance article of this Section.

B. Seismically brace raceways, cable trays, and suspended bus duct to conform to the requirements listed under the Quality Assurance article of this Section.

C. Provide pipeline seismic flexible connectors where piping crosses building earthquake joints. Arrange raceways and connectors for the amount of motion required. Maintain continuity of the grounding system for each of the joints.

D. Do not use powder-actuated inserts.

E. Seismic Restraints:
   1. Attach to structural members of the building, which are capable of withstanding the design load of the seismic restraint.
   2. Ensure load capacity of the structural members is greater than or equal to the capacity of the seismic restraint.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Labels

1.02 RELATED SECTIONS

A. Division 01, General Requirements
B. Division 26, Electrical
C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables
D. Section 26 0533, Raceways and Boxes for Electrical Systems
E. Section 26 0943, Network Lighting Controls
F. Section 26 2200, Low Voltage Transformers
G. Section 26 2413, Switchboards
H. Section 26 2416, Panelboards
I. Section 26 2726, Wiring Devices
J. Section 26 2900, Motor Controllers
K. Section 26 3213, Engine Generators
L. Section 26 5000, Lighting

PART 2 PRODUCTS

2.01 LABELS

A. Pre-printed:
   1. Permanent material pre-printed with black on white, with adhesive backing.
   2. Manufacturer:
      a. Brady
      b. 3M
      c. Or equal.

B. Engraved Laminated Plastic:
   1. 3-ply laminated plastic, colors indicated herein, with beveled edges, engraved letters, and stainless steel screw attachment.
   2. Nameplate length to suit engraving.
   3. Adhesive attachment is not acceptable.

C. Clear Plastic Tape:
   1. Black (normal) or red (emergency or standby) 12 point Helvetica medium text, clear adhesive backing, field printed with proper equipment for device labeling.
   2. Manufacturers:
      a. Brother P-Touch
      b. Dyno-tape
      c. Kroy
      d. Or equal.

D. Wire Markers:
   1. White with black numbers, adhesive-backed tape on dispenser roll.
   2. Manufacturers:
      a. Brady
      b. 3M
      c. Or equal.

E. Feeder Conduit Marking:
   1. Provide one-piece snap-around vinyl feeder conduit markers for feeder conduits.
   2. Provide custom label, black letters on orange background indicating destination equipment, 1-1/4-inch high letters (minimum) – Seton Setmark Pipe Marker Series.
   3. Provide additional one-piece snap-around vinyl label, black letters on orange background for voltage designation (i.e., 277/480V, 120/208V).
   4. Secure labels to conduits using plastic tie wrap, two per label.

F. Marker Pen: Black permanent marker suitable for writing on metallic surfaces.

PART 3 EXECUTION

3.01 GENERAL

A. Nameplate and text coloring:

1.	Normal	Black nameplate with white lettering.
2.	Emergency	Orange nameplate with black lettering.
3.	Standby	Yellow nameplate with black lettering.
4.	UPS	Blue nameplate with white lettering.

3.02 SWITCHGEAR, SWITCHBOARDS, DISTRIBUTION PANELS, MOTOR CONTROL CENTERS

A. Provide engraved laminated plastic nameplates for main and feeder protective devices indicating the function or the load served (e.g., ELEV-5, PANEL 4HA, AHU-5, or SPARE) and the protective device trip rating (i.e., 175A). Text height: 3/8-inch.

B. Provide engraved laminated plastic nameplate for bussed spaces indicating the maximum ampere rating of future breaker, switch, or starter that may be installed (e.g., SPACE (225A)). Text height: 3/8-inch.

C. Provide engraved laminated plastic nameplate on the face of equipment enclosure as follows:
   1. Line 1: Equipment identification (e.g., MDP, SDP, or MCC 4H). Text height: 3/4-inch.
   2. Line 2: Equipment voltage, phase and wire quantity (e.g., 480Y/277V, 3-Phase, 4W). Text height: 1/2-inch.

D. Provide additional engraved laminated plastic nameplate to indicate upstream source and location of upstream source as follows:
   1. Line 1: Upstream source equipment (e.g., FED FROM MDP). Text height: 3/8-inch.
   2. Line 2: Location of upstream source (e.g., MAIN ELEC ROOM 102). Text height: 3/8-inch.
   3. Confirm final room designations with Architect and Owner prior to procurement of nameplates.

3.03 DISTRIBUTION TRANSFORMERS

A. Provide engraved laminated plastic nameplate on the face of the equipment enclosure as follows:
   1. Line 1: Equipment identification (e.g., T-N2P). Text height: 3/4-inch.
   2. Line 2: Equipment kVA rating, primary and secondary voltages (e.g., 150kVA, PRI: 480V, SEC: 208Y/120V). Text height: 1/2-inch.

B. Provide additional engraved laminated plastic nameplate to indicate upstream source and location of upstream source as follows:
   1. Line 1: Upstream source equipment (e.g., FED FROM MDP). Text height: 3/8-inch.
   2. Line 2: Location of upstream source (e.g., MAIN ELEC ROOM 102). Text height: 3/8-inch
   3. Confirm final room designations with Architect and Owner prior to procurement of nameplates.

3.04 PLUG-IN BUSWAY AND PLUG-IN CIRCUIT BREAKERS

A. Provide engraved laminated plastic nameplate on the side of each plug-in busway at each core electrical room as follows:
   1. Line 1:
      a. Bus riser identification (e.g., LIGHTING BUS RISER, or POWER BUS RISER).
      b. Text height: 3/4-inch.
   2. Line 2:
      a. Bus riser ampere rating, voltage, phase, and wire quantity (e.g., 1600A, 480Y/277V, 3PH, 4W).
      b. Text height: 1/2-inch.

B. Provide engraved laminated plastic nameplate on the face of plug-in circuit breaker as follows:
   1. Line 1:
      a. Equipment served identification (e.g., T-N2P).
      b. Text height: 3/4-inch.
   2. Line 2:
      a. Circuit breaker trip rating, voltage, phase, and wire quantity (e.g., 175A, 480V, 3PH, 3W).
      b. Text height: 1/2-inch.

3.05 BRANCH CIRCUIT PANELBOARDS

A. Provide engraved laminated plastic nameplate on the face of each panelboard centered above the door as follows:
   1. Line 1:
      a. Equipment identification (e.g., PANEL 4HA).
      b. Text height: 1/2-inch.
   2. Line 2:
      a. Equipment voltage, phase, and wire quantity (e.g., 480Y/277V, 3PH, 4W).
      b. Text height: 3/8-inch.

B. Indicate feeder source, feeder wire size, and feeder breaker or fuse size with plastic tape labels on the inside of the panel door.

C. Provide typewritten panel directories, with protective, clear transparent covers, accurately accounting for every breaker installed including spares.
   1. Schedules use the actual room designations assigned by name or number near completion of the work and not the space designation on the Drawings. Confirm final room designations with Architect and Owner prior to completion of work.
   2. Each load description includes a room or area designation whether indicated on the Drawings or not.

3.06 EQUIPMENT

A. Provide engraved laminated plastic nameplate on the face of disconnect switches, motor starters, relays, contactors, and etc., indicating equipment served (e.g., AHU-1) and equipment load (e.g., 20 hp). Provide additional engraved laminated plastic nameplate indicating serving panel designation and circuit number.

B. Provide clear plastic tape label for relays, contactors, time switches, and miscellaneous equipment provided under this Division of work indicating equipment served.

3.07 FEEDER CONDUIT

A. Provide feeder conduit marker for electrical feeders.

B. Provide markers when exiting source equipment and located along the entire conduit length 20-feet on centers in exposed areas, above ceilings, and upon entering or leaving an area or room.

3.08 DEVICES

A. Label each receptacle plate with preprinted clear plastic tape indicating serving panel and circuit number (e.g., PANEL 2PA-5). Clean oils, dirt, and foreign materials from plate prior to label application. Label receptacles connected to a GFCI protected circuit downstream from the protecting device.

3.09 RACEWAYS AND BOXES

A. Label pull boxes and junction boxes for systems with paint or marker pen on box cover identifying system. Where box covers are exposed in finished areas, label inside of cover.

B. Color label covers as follows:

1. 480Y/277V wiring	Orange
2. 208Y/120V wiring	Black
3. Fire Alarm	Red
4. Communications	Green
5. Security	Blue

C. Label each end of pull wires left in empty conduits with tags or tape indicating location of other end of wire.

3.10 SYSTEMS

A. Complex control circuits may utilize combination of colors with each conductor identified throughout using wraparound numbers or letters. Use the number or letters shown where the Drawings or operation and maintenance data indicate wiring identification.

B. Label the fire alarm and communication equipment zones, controls, indicators, etc., with machine-printed labels or indicators appropriate for the equipment installed as supplied or recommended by the equipment manufacturer.

END OF SECTION

SECTION 26 0573

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Studies and Analysis

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 2200, Low Voltage Transformers

E. Section 26 2413, Switchboards

F. Section 26 2900, Motor Controllers

1.03 REFERENCES

A. IEEE 141 Recommended practice for electrical power distribution and coordination of industrial and commercial power systems

B. IEEE 242 Recommended practice for protection and coordination of industrial and commercial power systems

C. IEEE 399 Recommended practice for industrial and commercial power system analysis

D. IEEE 1584 Guide for performing arc-flash hazard calculations

E. NFPA 70 National Electrical Code, latest addition

F. NFPA 70E Standard for Electrical Safety in the Workplace, latest addition

1.04 SUBMITTALS

A. Overcurrent Device Coordination Study

B. Device Setting Recommendations

C. Arc Flash Hazard Analysis and report

D. Arc Flash Equipment Labeling Recommendations

E. Arc Flash Label Example

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Emerson

B. Electrical Systems Analysis

C. Qualified engineers of the switchgear manufacturer.

2.02 STUDIES AND ANALYSIS

A. Overcurrent Device Coordination Study:
   1. Provide a coordination study for the electrical overcurrent devices to assure proper equipment and personnel protection.
   2. Present an organized time-current analysis of each protective device in series from the individual device back to the source. Reflect the operation of each device during normal and abnormal current conditions.
   3. Complete and submit prior to procurement of electrical distribution equipment including: switchgear, switchboards, panelboards, disconnects and overcurrent protection devices.

4. Demonstrate selective coordination of the emergency system 700 and legally required standby system 701 in conformance with Oregon Electrical Specialty Code (OESC). 700 and 701 system(s) overcurrent devices shall be selectively coordinated with all supply side overcurrent protective devices. The protection shall be selectively coordinated using the higher of the normal power supply fault current levels or emergency system fault current levels. Per OESC overcurrent devices shall be selectively coordinated for .01 seconds and greater.
5. Bring to the attention of the Engineer devices that fail to selectively coordinate as required to meet code.
6. Provide alternative options and/or scenarios for devices that fail to coordinate and demonstrate methods/devices needed to selectively coordinate for the engineers review and acceptance.
7. Provide pertinent information required by the preparers to complete the study.
8. Include a system one-line diagram and protective coordination curves.
    a. Determine the required settings of protective devices to assure selective coordination.
    b. Graphically illustrate on log paper that adequate time separation exists between series devices.
    c. Plot the specific time-current characteristics of each protective device so that upstream devices are clearly depicted on one sheet.
    d. Time Current Curves: Develop for both phase and ground protective devices.
    e. Provide the following specific information shown on the coordination curves:
        1) Device identification.
        2) Voltage and current ratio for curves.
        3) 3-phase and 1-phase ANSI damage points for each transformer.
        4) No-damage, melting, and clearing curves for fuses.
        5) Cable damage curve.
        6) Transformer inrush points.
        7) Maximum short circuit cut-off point.
        8) Motor starting locked rotor curves.
        9) Clearly marked short circuit current levels through each protective device and branch.
    f. Develop a table that summarizes the settings selected for the protective devices. Included the following:
        1) Device identification.
        2) Circuit breaker sensor rating, long-time, short-time, instantaneous settings, and time bands.
        3) Fuse rating and type.
        4) Ground fault pickup and time delay.
        5) Provide characteristic time-current curves for each adjustable overcurrent protective device showing pickup settings, time delay bands, and device operating times. Include trip adjustment time dials and available settings corresponding to each characteristic time-current curve.

B. Arc Flash Hazard Analysis:
1. Provide an Arc Flash Hazard Study per the requirements set forth in NFPA 70E. The arc flash hazard analysis performed according to the IEEE 1584 equations that are presented in NFPA70E.
2. Use study to determine:
    a. Arc flash incident energies.
    b. Arc flash boundaries.
    c. Shock hazard boundaries.
    d. Personal protective equipment (PPE) for energized electrical equipment.
3. Provide the following information for each system mode of operation and documented. The study includes:
    a. Equipment name and voltage.

b. Equipment device name and ANSI function
c. Equipment type
d. Equipment arc gap
e. Bolted and estimated arcing fault current at the fault point (equipment) in symmetrical amperes. The estimated arcing current should be based on the arcing current equations used.
f. Trip time, opening time, and total clearing time (total Arc time) of the protective device.
g. Worst-case arc flash boundary for each bus/equipment in the model.
h. Worst-case arc flash hazard incident energy in cal/cm2 for each bus/equipment in the model.
i. Worst-case personal protective equipment (PPE) for each bus/equipment in the model.
j. Indicate Danger/Hazardous areas where incident energy is greater than 40 cal/cm2 and provide recommendations to reduced arc flash energy levels for these areas.
k. Flag results where 85 percent arcing current provided worst-case results.

4. Arc flash study report format:
   a. Introduction
   b. Methodology
   c. Backup Information
   d. Key Assumptions
   e. IEEE 1584-2002 Considerations
   f. Arc flash reduction options: Overcurrent protective device changes.
   g. Explanation of data in arc flash hazard report tables.
   h. NFPA 70E Information.
      1) Shock hazards with covers removed.
      2) Shock hazard approach boundaries:
         a) Limited Approach Boundary
         b) Restricted Approach Boundary
         c) Prohibited Approach Boundary
      3) Arc Flash Hazard Boundaries
   i. Results of arc flash hazard analysis for high voltage, medium voltage, and low voltage systems, including:
      1) Working Distances
      2) Energy Levels
      3) PPE Requirements
      4) Recommendations to reduce arc flash hazard energy and exposure.
   j. Arc Flash Hazard Report
   k. Electronic File
5. Provide labels for the project.

PART 3 EXECUTION

3.01 SETTINGS AND ADJUSTMENT

A. Set and adjust breakers in the distribution system per the recommendations of the coordination study and settings table.

B. Provide protective covers and locking devices on breakers to secure settings from accidental changes.

3.02 ARC FLASH WARNING LABELS

A. Provide a 3-1/2-inch by 5-inch thermal transfer type label of high adhesion polyester for each work location analyzed.

B. Labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the Owner and after any system changes, upgrades, or modifications have been incorporated in the system.

C. The label includes the following information, at a minimum:
   1. Location Designation
   2. Nominal Voltage
   3. Flash Protection Boundary
   4. Hazard Risk Category
   5. Incident Energy
   6. Working Distance
   7. Engineering Report Number, Revision Number, and Issue Date

D. Machine printed labels with no field markings.

E. One arc flash label provided for each, unit substation primary and secondary side, switchboard, switchgear section, motor control center, panelboard, and busway.

3.03 ARC FLASH TRAINING

A. Train the Owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Training certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) of equivalent.

END OF SECTION

SECTION 26 0580
ELECTRICAL TESTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Testing Equipment

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0913, Electrical Power Monitoring and Control

F. Section 26 0943, Network Lighting Controls

G. Section 26 2413, Switchboards

H. Section 26 2416, Panelboards

I. Section 26 2900, Motor Controllers

J. Section 26 3213, Engine Generators

K. Section 26 3623, Automatic Transfer Switches

1.03 TESTING CRITERIA

A. General:
   1. Perform field tests and operational checks to assure that all electrical equipment, both contractor and Owner supplied, is operational within industry and manufacturer's tolerances, and is installed in accordance with design specifications.
   2. The tests and operational check shall determine the suitability for energization.
   3. Schedule tests and give a minimum of one week's advance notice of time and date to the Architect and Owner for any major systems tests specified in this Section.
   4. The testing company shall provide the equipment and technical personnel to perform all tests and inspections. At Contractors expense, furnish any personnel necessary to assist in the testing and inspection.
   5. When tests and inspections are complete, attach a label to the devices tested. Provide on the label, the name of the testing company, date of tests, and initials of the Engineer who performed the tests.

B. Responsibilities:
   1. Clean the equipment, torque down accessible bolts according to the equipment manufacturer's instructions; perform routine insulation resistance tests on branch and feeder circuits, continuity checks on branch and control wiring, and rotation tests for distribution and utilization equipment.
   2. Furnish a complete set of current plans and specifications to the testing company prior to commencement of testing. At each test site, provide test control power necessary to perform the tests specified. Consult the test organization as to the specific power requirements. Notify the testing organization when the equipment and systems are ready for their inspections and testing. After review by the testing engineer, correct deficiencies noted by the testing company.

3. Responsible for having the manufacturer of each equipment and/or system provide factory trained representatives(s) that will perform required functional testing, checkout, and repairs in order to pronounce the equipment and/or systems meet the requirements of these specifications and Drawings and it is ready for startup testing and commissioning by the testing organization as specified hereafter.
4. Furnish settings of protective devices by the Engineer, in conjunction with Utility.
5. Testing organization to notify Engineer prior to the commencement of testing. The testing organization, set, and adjust the protective devices and associated auxiliary timing devices in accordance with the values furnished by the Engineer. The testing organization maintains a written record of tests and, upon completion of the test, include them in a final report. Detail deficiencies in the system material, workmanship, or design.

C. Implementation:
1. Safety practices comply with applicable state and local safety orders, as well as with the Occupational Safety and Health Act (OSHA). Compliance with the National Fire Protection Association (NFPA) standard NFPA 70E, and the Accident Prevention Manual for Industrial Operations of the National Safety Council.
2. Tests, other than phase rotation and operational tests, only performed on apparatus that is deenergized. The testing company's lead test engineer for the project designated safety representative and supervise testing observations and safety requirements. Do not proceed with Word until determined that it is safe to do so.
3. Power Circuits: Conductors shorted to ground by a hotline grounding device approved for the purpose. Provide warning signs and protective barriers as necessary to conduct the tests safely.

D. Reports:
1. General: Provide full documentation of tests in the form of a report.
2. Test report includes the following sections:
   a. Scope of Testing
   b. Equipment Tested
   c. Description of Test
   d. Test Results
   e. Conclusions and Recommendations
   f. Appendix, including Test Forms
3. Record each piece of equipment on a data sheet listing the condition of the equipment as found and as left. Include recommendations for necessary repair and/or replacement parts. Indicate on data sheets the name of the engineer who tested the equipment and the date of the test completion.
4. Submit record copies of the completed test report no more than 30 days after completion of the testing and inspection.

1.04 REFERENCES

A. The testing and inspection comply with applicable sections of the applicable codes and standards listed in Section 26 0500, Common Work Results of Electrical of the project specifications.

B. The inspection and testing comply with the project plans and specifications, as well as with the manufacturer's drawings, instruction manuals, and other applicable data that may be provided by the Engineer, for the apparatus tested.

1.05 QUALIFICATIONS

A. Testing Organization:
1. Independent division of the manufacturer of the assembled products being tested. If an outside testing organization is utilized, a representative of the manufacturer under contract by the testing company. Be present during testing to ensure the testing is performed properly and deficiencies discovered are promptly corrected.
2. Full Service Company that employs factory trained test engineers capable of troubleshooting, as well as identifying power equipment problems.

3. Perform Work outlined under the full time, onsite supervision of a graduate engineer with a minimum of 5 years of field testing experience.
4. Upon request, submit proof of its qualifications.

PART 2 PRODUCTS

2.01 TESTING EQUIPMENT

A. Testing agency to have calibration program, which maintains applicable test instrumentation within rated accuracy. Traceable accuracy to the National Bureau of Standards in an unbroken chain. Calibrate instruments calibrated in accordance with the following frequency schedule:
   1. Field Instruments: 6 months maximum.
   2. Laboratory Instruments: 12 months.
   3. Leased Specialty Equipment: 12 months (where accuracy is guaranteed by lessor). Dated calibration labels visible on test equipment.

PART 3 EXECUTION

3.01 EQUIPMENT TO BE TESTED

A. Section 26 0519, Low Voltage Electrical Power Conductors and Cables:
   1. For circuits rated 400A or higher perform tests listed in the NETA 2017 Acceptance Testing Specifications for Low-Voltage Cables, Section 7.3.2.

B. Section 26 0526, Grounding and Bonding for Electrical Systems:
   1. Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Grounding Systems, Section 7.13.

C. Section 26 0913, Electrical Power Monitoring and Control:
   1. Instrument Transformers: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Instrument Transformers, Section 7.10.
   2. Metering Functions: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Metering, Section 7.11.

D. Section 26 2413, Switchboards:
   1. Switchboards: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Switchgear and Switchboard Assemblies, Section 7.1.
   2. Circuit Breakers: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Low-Voltage Circuit Breakers, Section 7.6.1.1.

E. Section 26 2416, Panelboards:
   1. Panelboards: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Switchgear and Switchboard Assemblies, Section 7.1. Only those tests applicable to panelboards need be performed, no electrical tests of the circuit breakers need to be performed.

F. Section 26 2900, Motor Controllers

G. Section 26 3623, Automatic Transfer Switches:
   1. Transfer Switches: Perform tests listed in the NETA 2017 Acceptance Testing Specifications for Automatic Transfer Switches, Section 7.22.3.

END OF SECTION

SECTION 26 0800

COMMISSIONING FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

A. The commissioning process is described in Section 01 9100, Commissioning.

B. Provide all labor and materials required to complete the commissioning of those Division 26, Electrical, systems and equipment identified as Commissioned Systems and Equipment in Section 01 9100, Commissioning.

1.02 RELATED SECTIONS INCLUDE:

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 01 9100, Commissioning.

1.03 SUBMITTALS

A. Refer to Section 01 9100, Commissioning.

1.04 COMMISSIONING SCOPE OF WORK - COMMISSIONING AGENT

A. Refer to Section 01 9100, Commissioning.

1.05 COMMISSIONING SCOPE OF WORK - CONTRACTOR

A. Refer to Section 01 9100, Commissioning.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Refer to Section 01 9100, Commissioning.

PART 3 EXECUTION

3.01 MEETINGS

A. Refer to Section 01 9100, Commissioning.

3.02 INSTALLATION, CHECK-OUT, START-UP AND PREFUNCTIONAL CHECKS

A. Refer to Section 01 9100, Commissioning.

3.03 FUNCTIONAL TESTING

A. Refer to Section 01 9100, Commissioning.

3.04 TRAINING OF FACILITY OPERATING STAFF AND BUILDING OCCUPANTS

A. Refer to Section 01 9100, Commissioning.

END OF SECTION

SECTION 26 0913

ELECTRICAL POWER MONITORING AND CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Microprocessor-Based Metering Equipment
   2. System Architecture
   3. Metering and Monitoring Functions

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0533, Raceways and Boxes for Electrical Systems

F. Section 26 0553, Identification for Electrical Systems

G. Section 26 0580, Electrical Testing

H. Section 26 2413, Switchboards

I. Section 26 2416, Panelboards

1.03 REFERENCES

A. Microprocessor metering equipment UL listed, CSA certified and meet IEEE Standard C37.90.1 for surge protection.

1.04 SUBMITTALS

A. Product data:
   1. Microprocessor metering equipment product literature with description of operational capability to perform specified metering functions and software analysis features, and communication protocol.
   2. Published operators' manuals for the microprocessor metering equipment.

B. Operation and Maintenance Manuals:
   1. Final set up and operators' manuals.
   2. Instruction books and/or leaflets.
   3. Recommended renewal parts list.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Leviton

B. Or approved equivalent.

2.02 MICROPROCESSOR-BASED METERING EQUIPMENT

A. General:
   1. Provide a complete system consisting of instrument transformers, metering instruments, trip units with metering functions; communications between components; communications with the building computer network; computers; operator interfaces at the switchgear; operator interfaces via networked computers; and other appurtenances as required for a complete system.
      a. Overall system communications TCP/IP over a dedicated Ethernet LAN. The system support a LAN comprised of either Category 5 cable at 10baseT or fiber optics at 100baseFX or a mix thereof.

b. The system may also utilize Modbus/TCP for communication with field devices over an RS-485 communications link at speeds up to 38.4k baud.
c. Connection to the building Ethernet network made at a single Ethernet gateway.

2. Configure system wiring so metering instrument can be isolated and removed from the system without the need to deenergize power or protective circuit. This requirement may be met in one of two ways:
   a. Connections to the metering instrument may be made using separable terminal blocks. The terminal blocks for CT circuits short the CT circuit prior to breaking the metering instrument circuit on removal and make the metering instrument circuit prior to unshorting the CT circuit on insertion. CT and PT or line voltage terminals finger safe when left disconnected and energized.
   b. Connections to the metering instrument may be made through test blocks with disconnecting switches for line and neutral voltage circuits and shorting switches for CT circuits.
3. Terminate system wiring on spade or ring terminals, except that only ring terminals utilized on CT circuits. System wiring within switchgear of switchboard assembly type SIS.
4. Alarm and waveform capture set points may be created by the system operator based on the parameters defined below being greater than or less than value selected by the system operator.
5. Display, whether at the local display of a metering instrument or through software, auto range between units, kilo units or Mega units such that the absolute values less than 1,000 read as units, absolute values less than 1,000,000 but not less than 1,000 read as kilo units, and values of 1,000,000 or greater read as Mega units, except that voltage readings in units of Volts and kilovolts not be utilized.
6. Measured values, both instantaneous readings and historical data, available to users on a computer on the Ethernet network in the building without the use of proprietary software, or requiring particular operating system. To facilitate this, each metering device assigned a unique network address and by entering that address or corresponding URL into a web browser, HTML web pages of data available for that device. Specific browser software permitted to be required to access system features beyond the measured values.
7. System settings and operational parameters only accessible through a maximum of five specific user computers, require the use of proprietary software, and fully password protected.
8. Synchronize complete system to a single time base so that events on the system can be compared at different locations on the system using a common time base.
9. Capable of monitoring Modbus devices for which register values are defined.
10. System requirements indicated are minimum requirements, additional features and increased accuracy is permitted.
11. Historical data resides on the system, independent of external personal computers. Industrial computers included as integral components of the system and mounted within a switchgear enclosure may be used to supplement the storage capacity of the various metering devices in the system. Sufficient data storage space included so that each instantaneous value listed can be logged on one minute increments and maintained for 36 hours. After 36 hours, data retained at 15 minute intervals for 35 days. After 35 days, data retained at 1 hour intervals for a minimum of one year.

B. Shared Components:
   1. Where the accuracy of the protective relay metering functions or circuit breaker trip unit metering functions are sufficient to meet the requirements listed below, those metering functions may be used in lieu of separate metering instruments.

2.03 SYSTEM ARCHITECTURE

A. Intent is to provide an ASHRAE 90.1-2019 compliant power monitoring ~~Complete power monitoring~~ and measuring system consists of metering and monitoring equipment to measure the power, current, and voltage characteristics **of the intended breakers/feeders.**

B. See one-line diagram for metering points.

~~A.~~**C. The following electrical loads to be metered separately: HVAC loads, interior lighting, exterior lighting, receptacle loads, kitchen, elevator.** ~~, as enumerated below, for the following breakers:~~

~~1. Main Distribution Panel MSB.~~

~~2. Feeder Breaker, 4000A Frame, MCCB:~~

~~a. Current~~

~~b. Bus Voltage~~

~~c. Power Factor~~

~~d. Frequency~~

~~e. Power~~

~~f. Energy~~

2.04 METERING AND MONITORING FUNCTIONS

A. Current Metering: Where current metering is required, the system provides the following values and accuracy:
   1. Three Phase MCCB Breakers:
      a. Accuracy: 1.0 percent of reading plus or minus 0.5 percent of full scale.
      b. Values: For each of the following values provide the instantaneous value, the minimum values since the last reset, and the maximum value since the last reset.
         1) Each Phase
         2) Neutral, where present
         3) Ground
         4) Three Phase Average
         5) Percent Unbalanced
         6) Demand, Each Phase
         7) Demand, Three Phase Average
   2. Single Phase MCCB Breakers:
      a. Accuracy: 1.0 percent of reading plus or minus 0.5 percent of full scale.
      b. Values: For each of the following values provide the instantaneous value, the minimum values since the last reset, and the maximum value since the last reset.
         1) Phase

B. Voltage Metering: Where voltage metering is required, the system provide the following values and accuracy:
   1. Three Phase MCCB breakers:
      a. Accuracy: 1.0 percent of reading plus or minus 0.5 percent of full scale.
      b. Values: For each of the following values provide the instantaneous value, the minimum values since the last reset, and the maximum value since the last reset.
         1) Line to Line for each phase
         2) Line to Neutral for each phase
         3) Neutral to Ground
         4) Line to Line Three Phase Average
         5) Line to Neutral Three Phase Average
         6) Percent Unbalanced

C. Power Factor: Where power factor metering is required, the system provide the following values and accuracy:
   1. Three Phase MCCB Breakers:
      a. Accuracy: Plus or minus 0.02.
      b. Values: For each of the following values provide the instantaneous value, the minimum values since the last reset, and the maximum value since the last reset.
         1) True Power Factor, Line to Neutral or Line to Ground for each phase
         2) True Power Factor, Three Phase

D. Frequency: Where frequency metering is required, the system provide the following values and accuracy:
   1. Three Phase MCCB breakers:
      a. Accuracy: Plus or minus 0.01 Hz.
      b. Values: For each of the following values provide the instantaneous value, the minimum values since the last reset, and the maximum value since the last reset.
         1) Frequency

E. Power Metering: Where power metering is required, the system provide the following values and accuracy:
   1. Three Phase MCCB breakers:
      a. Accuracy: 2.0 percent of reading plus or minus 0.5 percent of full scale.
      b. Values: For each of the following values provide the instantaneous value, the minimum values since the last reset, and the maximum value since the last reset.
         1) Real Power Line to Neutral or Line to Ground, Each Phase
         2) Real Power, 3- phase total
         3) Reactive Power Line to Neutral or Line to Ground, Each Phase
         4) Reactive Power, 3-phase total
         5) Apparent Power Line to Neutral or Line to Ground, Each Phase
         6) Apparent Power, 3-phase total
         7) Demand Real Power Line to Neutral or Line to Ground, Each Phase
         8) Demand Real Power, 3-phase total
         9) Demand Reactive Power Line to Neutral or Line to Ground, Each Phase
         10) Demand Reactive Power, 3-phase total
         11) Demand Apparent Power Line to Neutral or Line to Ground, Each Phase
         12) Demand Apparent Power, 3-phase total

F. Energy Metering: Where energy metering is required, the system provide the following values and accuracy:
   1. Three Phase MCCB breakers:
      a. Accuracy: 2.0 percent of reading plus or minus 0.5 percent of full scale.
      b. Values: For each of the following values provide the instantaneous value, the minimum values since the last reset, and the maximum value since the last reset.
         1) Real kWH
         2) Reactive kVARh
         3) Apparent kVAh

G. Trip: Where trip monitoring is required, the system provide the following information:

PART 3 EXECUTION

3.01 METER INSTALLATION AND POWER

A. Provide meters with a power source either internally within the electrical equipment from the factory or with an external circuit.

B. Coordinate internal power connections required and the factory installation of the meters with the electrical equipment manufacturer.

C. Where an external meter power connection is required, provide circuit breakers, conduit and conductors, and field installation required for functional meters.

D. Provide required installation, mounting, raceway and conductors for the meter(s), system communications and CT units for a complete working system.

3.02 FIELD TESTING

A. Verify complete system operation including hardware, software, and communication devices.

B. Test components per the requirements of Section 26 0580, Electrical Testing.

3.03 SYSTEM OPERATOR TRAINING

A. Provide onsite training for the Owner's system operations personnel. The training course minimum of 16 hours of classroom instruction and cover system operation and troubleshooting, alarm and waveform capture set points, system programming, web page customization for the user interface, and recommended periodic maintenance.

B. Provide a local or toll-free phone number to provide assistance to the Owner's operations personnel in the operation of the system for a minimum of five years. Costs associated with this assistance included in the original system cost.

3.04 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's representative certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

B. Provide 4 copies of the manufacturer's representative's certification.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Control Stations
   2. Standalone Room Controllers
   3. Occupancy/Vacancy Sensors
   4. Photosensor
   5. Relays, Switchpacks, and Room Controllers
   6. Power Supplies and Transformers
   7. Emergency Lighting Control Relays
   8. Low Voltage Control Wiring
   9. Test Equipment

B. Responsibilities and participation under Division 26, Electrical in the automatic dimming system installation and commissioning process.

C. Installation, connection, adjustment, and testing of the equipment including labor, materials, tools appliances, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational lighting control system

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0943, Network Lighting Controls

D. Section 26 0993, Sequence of Operations for Lighting Controls

E. Section 26 2726, Wiring Devices

F. Section 26 5000, Lighting

1.03 GENERAL REQUIREMENTS

A. Provide qualified personnel for participation in commissioning tests, including seasonal testing required after the initial commissioning.

B. Providing equipment, materials, and labor necessary to correct deficiencies found during the commission process which fulfill contract and warranty requirements.

C. Provide Operating and Maintenance Data and Record Drawings to the Test Engineer for verification, organization, and distribution.

D. Provide assistance to the Test Engineer to develop and edit descriptions of system operation.

E. Providing training for the systems specified in this Division with coordination by the Test Engineer and Commissioning Agent.

1.04 SUBMITTALS

A. Shop drawings:
   1. Submittal drawings with a complete system diagram to show quantity of devices, location in the building, dimensions and required wiring.
   2. Occupancy sensors, show the required quantity to cover the space controlled (note: this may be more than the quantity shown on the drawings.
   3. The locations shown on the drawings are for reference only and coordinated with the manufacturer and Architect for final quantity and location during the bid process to allow for allowance of proper quantity, wiring lengths and installation coordination)
   4. Provide physical samples of user interface devices and visually exposed control devices for approval by Owner and Architect.

B. Product data with wiring schematics for system and user interface components

C. Installation and Record Drawings

D. Operation and Maintenance Manuals:
   1. Include product data of system components, one line diagrams of installed components and their locations throughout the building, a final floor plan noting the locations of devices installed above ceilings, behind access panels or in concealed but accessible spaces and the lighting zones or devices they control.
   2. Final relay schedule with the zone of control, location of control zone, voltage, power feed, time clock setting, photocell set point, switch, or dimmer stations controlling the relay, and sweep function set points will be provided by the contractor.

1.05 DEFINITIONS

A.	BACNET	Protocol for integration with BAS/BMS/EMS
B.	BAS / BMS / EMS	Building Automated System, Building Management System, Energy Management System
C.	CS	Control Station
D.	D	Dimming Wall Switch
E.	DT	Dual Technology (PIR + U)
F.	FC	Footcandles. The metric for measuring light levels / illuminance levels
G.	GUI	Graphic User Interface
H.	LCP	Lighting Control Panel
I.	LED	Light Emitting Diode
J.	LonWorks	Protocol for integration with BAS/BMS/EMS
K.	OS/VS	Occupancy Sensor / Vacancy Sensor,

   1. Occupancy sensors provide automatic on and automatic shut-off.
   2. Vacancy sensors provide automatic shut-off only, and require manual-on.

L.	PC	Photocell
M.	PIR	Passive Infrared Technology
N.	RS	RS-232 Connection for AV Integration
O.	SC	Scene Control
P.	TC	Timeclock, or astronomical timeclock
Q.	U	Ultrasonic Technology
R.	WS	Wall Switch
S.	WS/O	Wallbox Occupancy Sensor Switch

   1. Wall Switch with integrated Occupancy Sensor

1.06 SYSTEM DESCRIPTION

A. Control Stations:
   1. Control Station Types:
      a. Provide control stations for occupant lighting control as scheduled on the drawings and may include and/or combine the following type of individual control type within a single station:
         1) Scene Selection
         2) On/Off Switching
         3) Dimming Raise/Lower
         4) Occupancy/Vacancy Sensor

B. Relays, Switchpacks, and Room Controllers:
   1. Analog and Digital: Room controller devices to accept line voltage input as well as input from any combination of control stations, occupancy/vacancy sensors and/or daylight sensors and produce the required effect (switching or dimming) on up to four zones of connected lighting.

C. Occupancy/Vacancy Sensing:
   1. Reduce electric energy consumption by reducing or eliminating lighting energy use in unoccupied spaces by switching lighting off with occupancy and/or vacancy sensors.

D. Photoelectric Daylight Harvesting:
   1. Daylit Areas:
      a. Reduce electric energy consumption during daylight hours by reducing the light output of the electric lighting system via continuous dimming power supply in response to measured lighting levels provided by daylight within the building interior.
      b. Dimming zones will correlate with the distribution of daylight within the space as noted on plans.

E. Emergence Override: Provide automatic load control relay devices for controlling egress lighting circuiting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
   1. Wattstopper

B. Approved Basis of Design Alternate Manufacturers:
   1. Acuity Controls (nLight, LC&D, Sensor Switch)
   2. Cooper Controls
   3. Lutron

C. Products described in this section are to be provided by the single BOD (basis of design), or approved alternate, manufacturer, listed above, or by a compatible, BOD approved third party alternate manufacturer.
   1. Manufacturer series numbers are identified herein to establish the minimum level of quality for each product.
   2. Comparable products that meet the requirements of the specification by other acceptable manufacturers identified herein are acceptable with prior approval.
   3. Other or equivalent Manufacturers and Products: Submit Substitution Request, complying with requirements of Division 00, Procurement and Contracting Requirements.

2.02 CONTROL STATIONS

A. Control Station Types:
   1. Scene Select: Provide five scene selection control station including discrete, engraveable pushbuttons allowing on/off and raise/lower control of entire space and means for occupants to select from five scenes indicated on drawings.
   2. On/Off:
      a. Provide individual pushbuttons for on and off control of zones indicated.
      b. Control lighting in entire space if no zones indicated on plans.
   3. Dimming/Raise Lower:
      a. Provide individual pushbuttons for on and off control of zones indicated on plans.
      b. Controls lighting in entire space if no zones indicated on plans.
      c. Dimming accomplished by separate up and down pushbuttons.
   4. Integral Occupancy:
      a. Automatically switches lighting on when occupant enters space.
      b. Switches lights off after predetermined period of vacancy.
      c. Controls lighting in entire space.

5. Integral Vacancy:
    a. Includes pushbuttons for occupant manual on/off and dimming control of lighting in space.
    b. Automatically switches lights off after predetermined period of vacancy.
    c. Includes provision to revert to occupancy control in absence of configurable amount of daylight.
    d. Controls lighting in entire space.

B. Line Voltage Dimming Switches:
1. Architectural grade, line voltage, 20A rated, single pole, preset style, slide up to brighten and down to dim, with on/off rocker style switch, decora style, wattage rating and lamp/power supply compatibility as required.
2. 0-10V.
3. Provide 3-way type where shown on plan.

C. Wallbox Occupancy Sensor Switches:
1. 180-degree coverage, type as shown on plan (PIR, ultrasonic or dual-technology), configurable automatic-on or manual on operation, 3-wire type, daylight override, adjustable time-out, selectable walk-through mode and override off switch. Single or dual relay type as required or as shown on Drawings.
2. Provide 3-way type where shown on plan.
3. WattStopper PW series.

D. Digital Control Stations:
1. Provide control stations with configuration as indicated or as required to control the loads as indicated.
2. General Requirements:
    a. Power: Class 2 (low voltage).
    b. UL listed.
    c. Provide faceplates with concealed mounting hardware, with matching finish.
    d. Borders, logos, and graduations to use laser engraving or silk-screened graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning. Self-Adhesive labels not permitted.
    e. Finish: As specified for wall controls in this Section.
3. Single-Zone or Single-Group:
    a. Turn an individual fixture or group of fixtures as shown on plans on and off via button press.
    b. Raise and lower light levels via press and hold button.
        1) Separate buttons for dimming and on/off functions not allowed.
4. Multi-Scene or Multi-Group:
    a. General Requirements:
        1) Allows control of any devices part of the lighting control system as indicated on plans.
        2) Controls can be programmed with different functionality through system software without any hardware changes. Allows contextual functions based upon button press and press and hold input.
        3) Allows for easy reprogramming without hardware replacement.
        4) System will automatically update programming without direct human interaction upon replacement of any component.
        5) Communications: Utilize RS485 or similar wiring for low-voltage communication.
        6) To help occupants understand how to use the lighting control system, engraving requirements should be included for controls. Engraving details should include text size and style.
        7) Engrave keypads with button, zone, and scene descriptions as indicated on the drawings.

8) Software Configuration:
   a) Single defined action.
   b) Buttons can be programmed to perform defined action on press and defined action on release.
   c) Buttons can be programmed using conditional logic off of a state variable such as time of day or partition status.
   d) Buttons can be programmed to perform automatic sequence of defined actions.
   e) Capable of deactivating select keypads to prevent accidental and/or unwanted changes to light levels and other settings.
   f) Buttons can be programmed for raise/lower of defined loads.
   g) Buttons can be programmed to toggle defined set of loads on/off.
9) Status LEDs:
   a) Upon button press, LEDs to immediately illuminate.
   b) Time delays inherent in large systems can cause short delays between button press and system confirmation. To avoid any confusion and prevent multiple button presses, keypads should immediately show that the button has been pressed for visual confirmation.
   c) LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or LEDs to turn off if the button press was not processed.
   d) Support logic that defines when LED is illuminated:
      (1) Scene logic (logic is true when zones are at defined levels).
      (2) Room logic (logic is true when at least one zone is on).
      (3) Pathway logic (logic is true when at least one zone is on).
      (4) Last scene (logic is true when spaces are in defined scenes).

b. Wired Keypads:
   1) Style:
      a) Mounting: Wall box or low-voltage mounting bracket; provide wall plates with concealed mounting hardware.
   2) Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
   3) Terminal block/connector inputs to be over-voltage and miswire-protected against wire reversals and shorts.
   4) LEDs next to each button are used during programming and provide feedback when the buttons are pressed.
   5) Available with status LEDs.
   6) Available in several button configurations and finishes.

2.03 STANDALONE ROOM CONTROLLERS

A. General:
   1. Provides a common, standalone interface via dimming and/or switching to a group of 0-10V Dimming or Fixed Output Ballasts and/or 0-10V LED Drivers.
   2. Direct conduit connection or provision for mounting to junction box.
   3. Physical barriers provided between Class 1 and Class 2 wiring as well as between normal power and emergency power wiring.
   4. Dual voltage 120/277V, 60HZ operation, 20A rating for each relay Relays utilize zero crossing technology for increased life.
   5. Plenum Rated.

B. Digital Room Controllers and Switchpacks:
   1. Replacement of any component requires no reconfiguration or reprogramming.
   2. Low voltage connections via CAT5/6 and RJ-45 connectors.

3. On board power supply for a minimum of six accessory devices including, but not limited to occupancy sensors and control stations.
4. Up to four on-board relays and accompanying 0-10V dimming channels.
5. Provision for IR or RF remote for configuration and editing of connected device settings.
    a. Provide means to copy settings from on system to another.
6. Field configurable to support, occupancy (automatic on) and vacancy (manual on) control protocol. Daylight harvesting feature for any number of zones.
7. Room Controller: WattStopper LMRC Series
8. Switchpack: WattStopper LMZC Series

C. Analog Room Controllers and Power Packs:
1. On board power supply for a minimum of six accessory devices including, but not limited to occupancy sensors.
2. Up to four on-board relays and accompanying 0-10V dimming channels.
3. Provision for IR or RF remote for configuration and editing of connected device settings.
    a. Provide means to copy settings from on system to another.
4. Field configurable to support, occupancy (automatic on) and vacancy (manual on) control protocol with optional daylight harvesting feature.

2.04 OCCUPANCY/VACANCY SENSORS

A. General Requirements:
1. Power Failure Memory: Settings and learned parameters to be saved in non-volatile memory and not lost should power be interrupted and subsequently restored.
2. Furnished with necessary mounting hardware and instructions.
3. NEC Class 1 or 2 devices, refer to plans.
4. Ceiling-Mounted Sensors: Indicate viewing directions on mounting bracket.
5. Wall-Mounted Sensors: Provide swivel-mount base.
6. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.
7. Isolated Relay: Provide ceiling mounted sensors with an internal isolated relay with Normally Open, Normally Closed, and Common outputs rated at 1A at 30VDC/VAC for use with HVAC control, Data Logging and other control options.
8. Line Voltage sensors accept line voltage input and output switched line voltage directly to controlled luminaires.
    a. Line voltage sensors must be capable of occupancy or vacancy control. Operation is to be determined by onboard device settings.
    b. Sensor configuration to be made by integral pushbutton or dial controls.
    c. Types:
        1) PIR: utilize invisible light to determine occupancy.
        2) Ultrasonic/Microphonic: utilize audible or subaudible sound to determine occupancy.
        3) Dual-Tech: utilize a combination of the above technologies to determine occupancy.
            a) Detection of vacancy by both ultrasonic and PIR sensors required to turn lights off.
9. Low Voltage sensors are paired with a switch pack or room controller. Provide digital sensors compatible with room controller/switchpack and balance of system.
    a. Low voltage sensors must be capable of occupancy or vacancy control. Operation is to be determined by overall system configuration and/or device settings.
    b. Sensor configuration to be made by IR or wireless handheld configuration tool.
    c. Types:
        1) PIR: utilize invisible light to determine occupancy.
        2) Ultrasonic/Microphonic: Utilize audible or sub-audible sound to determine occupancy.

3) Dual-Tech: Utilize a combination of the above technologies to determine occupancy.
   a) Detection of vacancy by both ultrasonic and PIR sensors required to turn lights off.

B. Ceiling Mounted: 360 degree coverage:
   1. Automatic-on operation, light-level sensing, adjustable time-out, automatic sensing/adjustment for optimal time-out delay setting, selectable walk-through mode.
   2. Low- or line-voltage as shown on Drawings or described in Section 26 09 93, Sequence of Operations for Lighting Controls,
   3. Surface mounted, provide power packs as required.
      a. Dual Technology Type:
         1) Low Voltage: WattStopper DT-300 Series.
         2) Line Voltage: WattStopper DT-355 Series
      b. Passive infrared type:
         1) Low Voltage: WattStopper CI-300 Series
         2) Line Voltage: WattStopper CI-355 Series
      c. Ultrasonic type:
         1) Low Voltage: WattStopper UT-300 Series
         2) Line Voltage: WattStopper UT-355 Series

C. Ceiling/Wall Mounted/Corner: 180 degree coverage:
   1. Automatic-on operation, light-level sensing, adjustable time-out, automatic sensing/adjustment for optimal time-out delay setting, selectable walk-through mode,
   2. Low-voltage with power pack, surface mounted as required.
      a. Dual Technology type: WattStopper DT-200 series.
      b. Passive infrared type: WattStopper CX-100 series.

D. Provide multiple contacts and/or power packs for Low Voltage occupancy sensors that:
   1. Control both normal and emergency lighting and require separation of branch circuit wiring systems. In case of occupancy sensor failure, emergency lighting fail to the on state.
   2. Control separate lighting control zones. Unless otherwise noted, occupancy sensors are intended to control light in a designated zone or room. Contractor is responsible for providing the required power packs to insure functionality of the system.
   3. Provide UL924 listed relay or power pack for to bypass occupancy sensors in event of power failure. During normal operation, relay to operate lighting in conjunction with adjacent normal power lighting.

E. Low Temperature/Wet Location Occupancy Sensor:
   1. Provide line voltage occupancy sensors where shown on plans.
   2. Automatic-on operation, light-level sensing, adjustable time-out, automatic sensing/adjustment for optimal time-out delay setting, selectable walk-through mode.
   3. Temperature Range at least -40 degrees F to +95 degrees F. With a minimum IP 65 rating.
   4. Surface mounted, provide auxiliary contacts if required.
      a. Passive infrared type: WattStopper CB-100 Series

F. High Ceiling Occupancy Sensor:
   1. Provide low or line voltage occupancy sensors where shown on plans.
   2. Automatic-on or manual-on operation, light-level sensing, adjustable time-out, automatic sensing/adjustment for optimal time-out delay setting, selectable walk-through mode.
   3. Suitable for mounting heights from 12-feet-40-feet.
   4. Surface mounted, provide auxiliary contacts if required.
      a. Passive infrared type: WattStopper HB Series

2.05 PHOTOSENSOR

A. General Requirements:
   1. Use NEC Class 2 wiring for low voltage communication.

2. Can be replaced without reprogramming.
3. Photopically corrected to approximate human vision.
4. Daylight sensing equipment will be digital, full range type, self or manually calibrated.
5. Provide proper photocell type(s) as required to:
    a. Measure lighting levels on an affected interior surface. Illumination contribution to this measured surface will include both daylighting and electric lighting (closed-loop system).
    b. Measure light levels entering space through glazing. Illumination contribution to this measured surface will include daylighting only (open-loop system).
    c. Measure light levels on affected interior surface and entering space through glazing. Illumination contribution to these measured surfaces will include both daylight and electric lighting (combination open and closed loop/dual loop system).
6. Independently control multiple zone(s) of luminaires for maximum energy savings while maintaining even task illumination across the entire area between zones. Refer to drawings for control groupings.
7. Incorporate time delay logic to prevent cycling due to clouds and other short-term influences to lighting levels.
8. Accept indoor, skylight, and outdoor photo sensing heads. Photo sensing control permit the user to specify the actual footcandle level where desired switching occurs.

B. Indoor:
1. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
2. Open Loop:
    a. Adjustable aiming angle to accommodate various glazing configurations
    b. Provide linear response from 0 to minimum 1000 foot-candles.
    c. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
    d. Wattstopper LMLS-500 Series.

C. Outdoor / Rooftop:
1. Outdoor models have a hood over the aperture to shield the sensor from direct sunlight.
2. The outdoor sensor circuitry completely encased in an optically clear epoxy resin.
3. Range between 0 and 750 FC.

D. Analog: Interior/Exterior: PLC CES Series

2.06 POWER SUPPLIES AND TRANSFORMERS

A. Provide from same manufacturer of equipment served.

B. Compatible with specified photocells and dimming control station protocols.

C. Refer to Section 26 5000, Lighting, for product specification on luminaire power supplies and transformers.

2.07 EMERGENCY LIGHTING CONTROL RELAYS

A. Manufacturers:
1. Wattstopper
2. Bodine
3. Nine 24
4. Or approved equivalent.

B. General Requirements
1. Comply with UL924 requirements:
    a. If controlled off, must turn on automatically.
    b. Provide required egress illuminance along entire egress path.
    c. Must not be able to be overridden by building occupants.
2. Unless shown otherwise on drawings, load control relay provided is to control egress lighting along with adjacent normal power lighting except in event of power failure.

3. Device can be integral to other components listed above or operate in conjunction with other lighting control components as a discrete component, but must be fed via UL 1008 compliant power source, such that in event of a power failure, control and dimming signals are bypassed and lighting operates at full power. Fed via the UL 1008 source.

C. Description:
   1. Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts.
   2. UL924 listed for connected load of 10A at 277V or 120V.
   3. UL rated N.C. contacts, minimum 10A rating.
   4. Integral surge protection.
   5. Two separate status emergency lighting indicators for troubleshooting:
      a. Amber LED indicates presence of normal utility power.
      b. Red LED indicates presence of unswitched emergency power.
   6. Manual and/or automatic diagnostic testing feature.
   7. Self-contained enclosure UL listed for installation in indoor or damp locations.

2.08 LOW VOLTAGE CONTROL WIRING

A. 18 gauge shielded cable or as recommended by the manufacturer.

2.09 TEST EQUIPMENT

A. Provide multi-function digital Illuminance meter with detachable receptor head with the following characteristics:
   1. Receptor: Silicon photocell type
   2. Illuminance Units: Lux or footcandles (switchable)
   3. Measuring range: 0.1 to 19,990 lux, 0.01 to 1,999 footcandles
   4. Accuracy: ±4 percent ±1 digit of displayed value
   5. Cosine Correction Characteristics: Within ±1 percent at 10 degrees; within ±5 percent at 60 degrees.
   6. Measuring functions: Illuminance, integrated illuminance, average illuminance.
   7. Temperature/humidity drift: Within ±3 percent ±1 digit (of value displayed at 68 degrees F) within operating temperature/humidity range.
   8. Operating conditions: 32 degrees F to 104 degrees F) at less than 85 percent humidity.

B. Provide proof of calibration within 12 months of use. Calibration performed by an independent calibration lab approved by the manufacturer of the meter.

PART 3 EXECUTION

3.01 INSTALLATION

A. Submittal data required prior to ordering and installation.

B. General Testing:
   1. Functionally test control devices to ensure that control devices, components, equipment and systems are calibrated, adjusted and operate in accordance with approved drawings, specifications, and manufacturers installation instructions.
   2. Prepare and complete report of test procedures and results and file with the Owner.
   3. Install items per manufacturers written instructions.

C. Control Stations:
   1. Control Stations to be combined wherever possible to minimize quantity of discrete gangs.
   2. Combine under common cover plates wherever shown together on plans.

D. Low Voltage Wiring:
   1. Install in conduit where running through inaccessible areas. Provide plenum rated wiring in accessible ceiling spaces.
   2. Test CAT5/6 cables terminated on site prior to wiring of digital lighting control systems. Provide evidence of successful testing to engineer and owner. Factory pre-terminated cabling is not subject to this requirement.
   3. Coordinate low voltage wiring connection and location with luminaires to be controlled.

E. Photocell:
   1. Install surface mounted on recessed junction box in location best suited for accurate measurement. Avoid placement in high traffic or confined spaces.

F. Occupancy Sensors:
   1. For installation of low voltage occupancy sensors in inaccessible ceiling systems, coordinate power pack locations with Architect prior to installation and provide access panels as required, coordinate access panel locations with Architect.
   2. Sensor locations identified on Drawings are diagrammatic and are meant to indicate only that occupancy sensing within a given space is required. Locate sensors as required by the manufacturer to provide maximum coverage of the room, to operate as someone enters the room, and to avoid false operation due to persons outside the room passing an open door.
      a. Provide additional sensing heads as necessary or per manufacturer's recommendation to achieve complete coverage of each room.
   3. Set sensitivity as required to provide small movement coverage throughout the room without extending coverage beyond the room.
   4. System performance testing done with the sensor timing set to the time delay indicated by space type in Section 26 0993, Sequence of Operations for Lighting Controls.
   5. Upon Completion of installation and prior to turning space over to Owner, Contractor reset occupancy sensor automatic self-adjustment settings to insure proper time delay self-adjustment for Owner occupant schedule and room use.
   6. Allow for up to 24 hours of callback sensor adjustments to be made by the contractor or occupancy sensor manufacturer qualified installer for up to six months after the owner has taken occupancy of the space.

G. Emergency Lighting Control Relays:
   1. Provide unswitched emergency circuit, and unswitched and switched normal circuit to UL924 relay for control of emergency luminaires with remaining room luminaires on normal power.
   2. Install each relay within dedicated 4-11/16-inch junction box with double-gang plaster ring for wall or ceiling flush-mount or in a self-contained enclosure from the manufacture, as indicated on Drawings.
   3. Where location in ceiling would interfere with removal of ceiling tiles, install relay flush-mounted in nearest wall at ceiling level.
   4. Do not locate behind wall switch.

3.02 WORK PRIOR TO COMMISSIONING

A. Complete phases of work so the system can be powered, tested, adjusted, and otherwise commissioned. Under Division 26, Electrical, complete systems, including subsystems, so they are fully functional. This includes the complete installation of equipment, materials, wire, controls, etc., in accordance with the contract documents and related directives, clarifications, change orders, etc.

B. A commissioning plan will be developed by the Test Engineer and approved by the Commissioning Agent. Under Division 26, Electrical, assist the Test Engineer and Commissioning Agent in preparing the commissioning plan by providing necessary information pertaining to the actual equipment and installation. If system modifications and clarifications are in the contractual requirements of this and related sections of work, they will be made at no additional cost to the Owner. If Contractor initiated system changes have been made that alter the commissioning process, the Commissioning Agent will notify the Owner.

C. Specific pre-commissioning responsibilities under Division 26, Electrical are as follows:
   1. Factory startup services for the following items of equipment:
      a. Lighting Control System
   2. Normal startup services required to bring each system into a fully operational state. This includes complete installation and cleaning. The Test Engineer will not begin the commissioning process until each system is documented as being installed complete.

D. Begin commissioning after installation of interior and exterior finishes including but not limited to adjacent roofing, finished floor, wall, and ceiling systems including final painting, furniture and book stacks in place, and other building systems which have direct or indirect influence on the performance and distribution of the daylight and electric lighting systems.

E. Start of commissioning before such items are complete will not relieve Contractor from completing those systems in accordance with the Construction Schedule.

3.03 SEQUENCE OF COMMISSIONING

A. Provide to Architect prior to start of commissioning layout drawings indicating proposed location of measurement points. Proceed with commissioning after review and acceptance by Architect.

B. Illuminance measurements oriented horizontal, facing up, at 30-inches above finished floor. Measurements for a control group occurs at the same location. Ensure constancy of local surface reflectance conditions throughout commissioning of each control group.

C. Ensure no personnel or outside influence affects the amount of flux striking the receptor head during the recording session.

D. Document measurements in clearly understandable format for review by the Architect. Include time of measurement, temperature, and relative humidity.

E. Measure illuminance at least two hours after local sunset with full output of electric lighting. Record integrated illuminance and average illuminance for a 2 hour period.

F. During daylight hours, measure illuminance with electric lighting off, including emergency and nightlight circuits. Record integrated illuminance and average illuminance for a two hour period. Document in clearly understandable format for review by the Architect.

G. Set each photocell to 150 percent of electric-only lighting contribution.

H. After initial setpoint has been set, measure illuminance in 10 minute increments from 1 hour before to 1 hour after local sunset.

I. Submit recorded data to Architect for review.

3.04 TESTING FOR SEASONAL VARIATIONS

A. Timing of Commissioning:
   1. Initial Commissioning:
      a. Perform to best suit the current time-of-year and cloud cover conditions.
      b. Conduct as done as soon as contract work is completed regardless of season.
   2. Seasonal Commissioning: Test under full sunlight and full overcast conditions during summer and winter solstice, as well as similar conditions at the spring or fall equinox.
   3. Subsequent Commissioning: Ascertain adequate performance during the four seasons.

3.05 PARTICIPATION IN COMMISSIONING

A. Provide skilled technicians to start up systems within Division 26, Electrical. The same technicians made available to assist the Test Engineer and Commissioning Agent 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, and coordinated by the Test Engineer. Under Division 26, Electrical, ensure that the qualified technician(s) are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments, and problem resolutions at no additional cost to the Owner.

B. System problems and discrepancies may require additional technician time, Test Engineer time, Commissioning Agent time, redesign, and reconstruction of systems and system components. The additional technician time made available for the subsequent commissioning periods until the required system performance is obtained at no additional cost to the Owner.

C. Commissioning Agent reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service the commission the equipment, and a willingness to work with the Test Engineer and Commissioning Agent to get the job done. Remove technicians from the project at the request of either the Test Engineer or Commissioning Agent.

3.06 RESOLUTION OF DEFICIENCIES

A. In some systems, misadjustments, misapplied equipment, and deficient performance will result in additional work required to commission the systems.

B. Complete work under the direction of the Architect, with input from the Contractor, equipment supplier, Test Engineer, and Commissioning Agent.

C. Whereas members will have input and the opportunity to discuss the work and resolve problems, the Architect will have final jurisdiction on the necessary work to be done to achieve performance.

D. Complete corrective work in a timely fashion to permit timely completion of the commissioning process.

E. Experimentation to render system performance is permitted. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Agent will notify the Owner, indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities.

F. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services, equipment, or both, to resolve the problem.

G. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

3.07 TRAINING

A. Participate in the training of Owner's engineering and maintenance staff, as required in Divisions 01 through 28, on each system and related components.

B. Conduct training in a classroom setting, with system and component documentation, and suitable classroom training aids.

C. Training classroom sessions and file demonstrations will be videotaped and copies of this material will be provided as part of closeout requirements.

D. Training will be conducted jointly by the test engineer, commissioning agent, the contractor, and the equipment suppliers.

E. Test engineer responsible for highlighting system peculiarities specific to this project.

3.08 SYSTEMS DOCUMENTATION

A. In addition to the requirements of Division 01, General Requirements, update contract documents to incorporate field changes and revisions to system designs to account for actual constructed configurations.

B. Division 26, Electrical, record drawings include architectural floor plans and the individual daylight control systems in relation to actual building layout.

C. Provide in AutoCAD .dwg format for transmittal to the test engineer.

END OF SECTION

SECTION 26 0943

NETWORK LIGHTING CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Lighting Control Equipment

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Division 23, Heating, Ventilation, and Air Conditioning

D. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

E. Section 26 0923, Lighting Control Devices

F. Section 26 2726, Wiring Devices

G. Section 26 5000, Lighting

1.03 QUALITY CONTROL

A. Install by an experienced contractor in the installation of lighting control systems. Provide a factory technician to supervise the installation and installation and make final adjustment and tests of the system.

B. Furnish evidence of an experienced service organization which stocks system parts and is capable of providing repair service within 24 hours.

1.04 SUBMITTALS

A. Shop Drawings

B. Product Data with Wiring Schematics

C. Installation and Record Drawings

D. Operation and Maintenance Manuals

1.05 SYSTEM OPERATION

A. Use a modular component approach, utilizing a central processor, transceivers which activate relays and relay cabinets.

B. Incorporate the following criteria:
   1. Control information from the controller to the transceiver multiplexed over a single pair of wires.
   2. Conform control wiring to NEC Article 725, Class 2.
   3. Components: Standard catalog items available through electrical distributors.
   4. Expandable to control up to 4,000 relays. Relays operable from 2 or 3-wire control systems.
   5. Programmable on site to achieve control functions and be readily updatable to reflect changes without requiring rewiring.

C. Installed system capable of the following control functions:
   1. Automatic Control: Areas to be activated in user dictated patterns (ON-OFF array of relays) according to either a weekly schedule broken into one-minute increments or alternate daily schedules pre-programmed for holidays.
   2. Manual Controls: Control relay or group of relays with either a maintained or momentary switch; activate group of relays to one of ten user determined patterns via a touchtone or pushbutton phone or the controller keyboard.

D. Select, activate, and lock-in lighting pattern from the central controller with provisions to lock out manual and automatic commands.

E. A CRT display capable of displaying:
   1. Pattern schedules and overrides.
   2. Priority manual overrides.
   3. Current state of each relay in system.
   4. Time, day, and date.

F. Indicate to the operator transceiver failure.

G. Internal battery backup of ten hours for memory protection. Store program information on a disc and automatically reload the controller after a power outage longer than the battery backup.

H. Capable of turning on circuits for continued operation should control component fail.

I. A self-diagnostic routine to indicate a malfunction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Blue Ridge Lighting Controls

B. Acuity Controls (nLight, LC&D, Sensor Switch)

C. Or approved.

2.02 LIGHTING CONTROL EQUIPMENT

A. Main Controller:
   1. Microcomputer pre-programmed for lighting control. Incorporate a 365-day clock and provide minute-by-minute control of the entire lighting system of up to 4,000 separate relays according to a pre-determined schedule.
   2. Accepts the lighting control schedule through a simple keyboard. In addition to the automatic schedule, control lighting circuit manually from the controller keyboard.
   3. Provide monitoring of the system and display the ON/OFF state of each relay.
   4. Capable of driving a standard printer.
      a. CPU: PC class personal computer with memory, cables, and software, factory tested prior to shipment.
      b. Include lighting control system operating software and current version of Windows operating system.
      c. Include Trends and Relay Runtime Analysis software to allow the owner to analyze the operation of specific areas and identify those exceeding normal runtimes. Individual relays may be assigned a kWh weighted value or simply analyzed on a runtime basis. In both cases, the relays may be assigned to logical groups and plotted for the last 30 days or 12 months.

B. Telephone Interface Unit:
   1. Built into the controller and allow the controller to connect to standard telephone system which has pushbutton (Touchtone) capability using a standard modular telephone jack.
   2. Each interface provides a telephone extension number for the controller. To increase accessibility to the controller, three of these interfaces built into the central controller.
   3. Capable of handling calls on three units simultaneously.

C. Relay/Transceiver Cabinets:
   1. Code gauge steel cabinets, surface, with cover and following interior devices.
      a. 20A, 277V relays with 24V, 2 or 3 wire control, quantities as scheduled with space for 32 minimum.
      b. 277V primary, 24V secondary control transformer.
      c. Plug-in modular electronics to operate multiple relays as schedules, individually or in groups as directed by the controller.
      d. Plug-in modular electronics for inputs which will notify the controller of change in input.
      e. Terminals for system wiring.

f. Transceivers for input output control.

D. Wire:
   1. Data line, 18 AWG minimum size, shielded twisted pair, stranded copper, color coded, 300V minimum insulation. Twist wires every 3-inches or less.
   2. Wiring from low voltage switches or other controlling devices to the transceivers inputs and wiring from transceivers to remote mounted relays 18 AWG minimum, stranded copper, color coded, 300V minimum insulation. Multiconductor cable assembly may be used at contractor's option.

E. Low Voltage Switch Modules:
   1. Master:
      a. G.E.
      b. RMP2-35-RK1 with RS2-37P switches
      c. Or approved.
   2. Single:
      a. G.E. RP2-117 with RS2-37P switches
      b. Or approved.

F. Photocells:
   1. Accept indoor, skylight, and outdoor photosensing heads.
   2. Photosensing control permits the user to specify the actual footcandle level where desired switching occurs.
   3. An internal deadband timer exist to prevent the lights under photosensor control to toggle inadvertently as the sensor passes through the control threshold.
   4. Provide one analog system photocell.

PART 3 EXECUTION

3.01 DRAWINGS

A. Installation and record drawings called for under submittals consists of reproducible drawings with outlets, devices, terminal cabinets, conduits and wiring shown. Prints of these drawings submitted for approval prior to starting installation. Upon request, the Architect will furnish reproducible floor plans as required for the contractor's use in developing the Installation and Record Drawings.

B. Submit drawings when approved and form the basis for installation.

C. Incorporate at the completion of the work deviations from the installation drawings on the reproducibles to indicate as built conditions. Submit drawings as Record Drawings for the system.

3.02 INSTALLATION

A. Install systems for each section of each floor and connect lighting circuits per relay schedule on drawings.

B. Area control switches able to manually provide 2-level control of lights by area.

C. Provide conduit for wiring, 1/2-inch minimum size.

D. Components for cabinets factory installed.

E. Install cabinets plumb, adjacent to serving lighting panel in electrical rooms as shown on the Drawings.

3.03 INSTRUCTION

A. Without additional expense to the Owner, competent authorized representative personnel gives instruction for the care, adjustment, and operation of all parts of the system to the Owner's representative who is to have charge of the equipment.

B. Each instructor thoroughly familiar with parts of the installation and trained in operating theory as well as in practical operation and system maintenance.

C. Furnish 16 hours of instruction after final acceptance of the system at the dates and times selected by the Owner.

D. Installation, start-up, and maintenance assistance available from the manufacturer on an as-needed basis.

E. After completion of commissioning, provide written program perimeters along with electronic copy of actual program to owner.

END OF SECTION

SECTION 26 0993

SEQUENCE OF OPERATIONS FOR LIGHTING CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Abbreviations and Definitions
   2. General Controls Approach
   3. Space-by-Space Sequence of Operations

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0923, Lighting Control Devices

D. Section 26 0933, Central Dimming Controls

E. Section 26 0943, Network Lighting Controls

F. Section 26 2726, Wiring Devices

G. Section 26 5000, Lighting

1.03 ABBREVIATIONS AND DEFINITIONS:

A.	BACNET	Protocol for integration with BAS/BMS/EMS
B.	BAS / BMS / EMS	Building Automated System, Building Management System, Energy Management System
C.	D	Dimming Wall Switch
D.	FC	Footcandles. The metric for measuring light levels / illuminance levels
E.	GUI	Graphic User Interface
F.	LCP	Lighting Control Panel
G.	LonWorks	Protocol for integration with BAS/BMS/EMS
H.	OS/VS	Occupancy Sensor / Vacancy Sensor
	1.	Occupancy sensors provide automatic on and automatic shut-off.
	2.	Vacancy sensors provide automatic shut-off only, and require manual-on.
I.	PC	Photocell
J.	RS	RS-232 Connection for AV Integration
K.	SC	Scene Control
L.	TC	Timeclock, or astronomical timeclock
M.	WS	wall Switch
N.	WS/O	Wallbox Occupancy Sensor Switch
	1.	Wall Switch with integrated Occupancy Sensor

1.04 SYSTEM DESCRIPTIONS

A. General Controls Approach:
   1. Exterior lighting tied to Blueridge networked relay control system centrally located in the building.
   2. Interior public spaces tied to stand-alone controls and local room controllers.
   3. Interior enclosed spaces tied to stand-alone controls and local room controllers for conference rooms and classrooms.
   4. Gymnasium spaces tied to nLight relay control system.
   5. Zones are identified on the drawing plans via ZXXX along with the luminaire type designations, and are scheduled on sheets E-002.

6. Lights in the theater to be controlled via stand-alone centralized dimming system that ties to the building control system.

B. Emergency Egress:
   a. Lights indicated as emergency to override to full output during power loss and fire alarm activation.
   b. Provide UL924 devices for emergency lights such that during normal power conditions the lights function (switch, dim by WS, dim by photocell, etc.) with the rest of the lights in the associated zone, and such that during emergency power conditions the lights override to full output.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPACE-BY-SPACE SEQUENCE OF OPERATION

A. Classrooms
   1. Provide dedicated room controller configured as manual on via control station and automatic off via occupancy sensor. Configure with a time delay of 15 minutes.
   2. Provide photocells at daylight zones as indicated on drawings. Configure photocell setpoint for gradual dimming of daylight zone for uniform illumination of space.
   3. Where provided, task lighting controlled separately from general ambient lighting.

B. Private Offices, Conference Rooms, Copy/Break Room, Library
   1. Provide dedicated room controller configured as manual on via control station and automatic off via occupancy sensor. Configure with a time delay of 15 minutes.
   2. Lights to be step dimmable at 25 percent, 50 percent, 75 percent and 100 percent lumen output.
   3. Provide photocells at daylight zones as indicated on drawings. Configure photocell setpoint for gradual dimming of daylight zone for uniform illumination of space.
   4. Where provided, task lighting controlled separately from general ambient lighting.

C. Public Spaces, Circulation, Stairs
   1. Provide dedicated controller configured for automatic on and automatic off via occupancy sensor. Configure with a time delay of 15 minutes.
   2. Provide photocells at daylight zones as indicated on drawings. Configure photocell setpoint for gradual dimming of daylight zone for uniform illumination of space.

D. Public Restrooms
   1. Provide occupancy sensor with automatic on and automatic off. Configure with a time delay of 15 minutes.
   2. Provide with local override keyed switch for maintenance.

E. Private Restrooms
   1. Provide occupancy sensor with automatic on and automatic off. Configure with a time delay of 15 minutes.
   2. Provide with local override control for manual off.

F. Exterior Lighting:
   1. Building mounted, façade, landscaping, plaza, site and parking lighting to turn on at dusk and off at dawn via digital software photocell.
   2. Site and parking lights to dim to 50 percent output and ramp to full on with activation of outdoor occupancy sensors integral to fixtures.

G. Back of House
   1. Storage spaces:
      a. Provide dedicated controller configured for automatic on/off via occupancy sensor with local override, wall box occupancy sensor switch. Configure with a time delay of 15 minutes.
   2. Electrical / Mechanical / IT / IDF / MDF:
      a. Rooms where personal safety is a concern to have line voltage switches only.

b. Provide signage at entry with words, Turn off the Lights, in large contrasting font. Coordinate sign with architect prior to installation.

H. Gymnasium
1. Provide dedicated room controller configured as automatic on/ automatic off via occupancy sensor. Configure with a time delay of 15 minutes.
2. Lights to be step dimmable at 25 percent, 50 percent, 75 percent and 100 percent lumen output.
3. Provide photocells at daylight zones as indicated on drawings. Configure photocell setpoint for gradual dimming of daylight zone for uniform illumination of space.

I. Other Spaces:
1. Sequence of operations will be provided upon written request for all spaces not listed. Reprogramming may be required of some spaces on site after installation to tune the system and meet the owner, daylight and energy management needs. Provide additional programming for reconfiguration up to 24 hours at no additional cost to the owner or design team.

END OF SECTION

SECTION 26 2200

LOW VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Indoor Low Voltage Transformers

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0533, Raceways and Boxes for Electrical Systems

F. Section 26 0553, Identification for Electrical Systems

G. Section 26 0580, Electrical Testing

1.03 SUBMITTALS

A. Shop Drawings with Nameplate Data

B. Product Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Transformers from the same manufacturer as the distribution equipment specified in Section 26 24 13, Switchboards; or approved equivalent.

2.02 INDOOR LOW VOLTAGE TRANSFORMERS

A. Enclosed and ventilated, air cooled type, Class 220 insulation, DOE 2016 Efficiency or NEMA Premium Efficiency. Equip with two 2-1/2 percent FCAN taps and four 2-1/2 percent FCBN taps. Maximum sound level to be NEMA standard with vibration isolators between the core and coil assembly and case.

B. NEMA standard maximum sound level with vibration isolators between the core and coil assembly and case. No metal-to-metal contact between core and coil and the enclosure. Warrant sound levels by the manufacturer not to exceed the following:
   1. 10 to 50 KVA 45 DB
   2. 51 to 150 KVA 50 DB
   3. 151 to 300 KVA 55 DB
   4. 301 to 500 KVA 60 DB
   5. 501 to 700 KVA 62 DB

C. Visibly ground the core of the transformer to enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC Standards.

D. Totally enclose the case with louvers to prevent entry of foreign objects into the interior, manufactured in accordance with NEMA and UL approval standards.

E. Provide grounded isolation shields between the primary and secondary windings where noted or shown on the Drawings to attenuate source of line interference. Insulate shield from the transformer windings and core and ground to transformer enclosure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install transformers with flexible conduit connections to housing. Make cable and ground wire connections.

B. Floor mount transformers. When necessary to wall or trapeze mount, securely anchor to structure as required for seismic Zone 3.

C. Install with sound isolating vibration dampers between the transformer enclosure and the hanger or building structure.

D. Provide nominally 3-inch deep concrete pads under floor-mounted transformers.

E. Provide seismic restraint for transformers as recommended by SMACNA. Provide shop drawings sealed by a registered Structural Engineer indicating this seismic restraint.

END OF SECTION

SECTION 26 2413
SWITCHBOARDS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Main Distribution Panels (MDP)
   2. Sub-Distribution Panels (SDP)
   3. Fuses
   4. Fuse Cabinets

B. Provide the materials for the complete secondary service and distribution system as indicated.

C. Provide a transformer pad and ground grid for use by the serving utility. Coordinate pad size, openings, type of construction, conduit arrangement, and grounding requirements with the utility prior to construction.

D. Provide utility metering facilities where indicated on the Drawings, complying with the established serving utility requirements. Provide quantity and style of meter sockets and accessories required by the utility.

E. Include metering charges or connection costs charged by the serving utility in the original proposal. Refer to Coordination of Work section of these Specifications.

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0553, Identification for Electrical Systems

F. Section 26 0573, Overcurrent Protective Device Coordination Study

G. Section 26 0580, Electrical Testing

H. Section 26 0913, Electrical Power Monitoring and Control

1.03 SUBMITTALS

A. Shop Drawings

B. Product Data:
   1. Detailed component material list.
   2. Voltage rating, amperage rating, bussing material, fault rating, wiring lugs capacity, mounting method, physical size, exterior finish and options.
   3. Equipment one-line diagram.
   4. Equipment elevations and dimensions.
   5. Conduit entry areas.
   6. Individual circuit breaker product data sheets.
   7. Panel schedules; the panel schedules indicate circuit breakers in the same orientation as the construction documents.

C. Equipment Test Reports

D. Operation and Maintenance Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton

B. General Electric

C. Siemens

D. Square D

2.02 MAIN DISTRIBUTION PANELS (MDP)

A. General:
   1. NEMA Standard PB-2 and UL 891 compliant.
   2. Freestanding, rear-aligned, front-accessible, group-mounted circuit breaker type, fully enclosed with bussing and hardware provisions for the addition of future circuit breakers.
   3. Circuit breaker trip ratings as indicated on Drawings.
   4. Equipment Assembly: Short circuit current rating (SCCR) greater than the maximum available fault current expected at that point in the distribution system.
   5. List panel by Underwriters Laboratories and bear a UL label as suitable for use as service equipment.
   6. Refer to Drawings for maximum allowable equipment footprint.

B. Construction:
   1. Equipment consists of the required number of vertical sections bolted together to form a rigid assembly.
   2. Formed edges of front covers or hinged front panels.
   3. Provide adequate ventilation within the enclosure.
   4. Rear align sections of the equipment with depth as required to accommodate devices shown and necessary conduit entrance for current and future devices.
   5. Properly clean and provide exterior and interior steel surfaces with a rust-inhibiting coating.
   6. Color and Finish: ANSI 61 light gray

C. Bus Work:
   1. Copper or tin-plated aluminum, sized as indicated on Drawings, with a 100 percent capacity neutral bus.
   2. Bus sizing based on NEMA standard temperature rise criteria of 149 degrees F above an ambient of 104 degrees F under continuous full load current and rated to withstand the maximum available fault current expected at that point in the distribution system.
   3. Include bussing provisions for mounting future devices in spaces called for on Drawings. Where configuration provides additional spaces within a section, bussed to receive future devices.
   4. Provide a copper ground bus firmly secured to each vertical section and extending the entire length of the MDP.
   5. Fully bus vertical sections.

D. Provide separate vertical section for service entrance conductor drip loop when Main Distribution Panel is installed below finished grade or when susceptible to water intrusion via service conduit. Install drip loop per serving utility requirements, if applicable.

E. Utility Metering:
   1. Where indicated on Drawings, provide a separately barriered utility metering compartment complete with hinged sealable door in accordance with utility requirements.
   2. Bus work includes provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company.

F. Circuit Breakers:
   1. Provide main and feeder circuit breakers as shown on Drawings.
   2. Molded case, bolt-on type, with inverse time and instantaneous tripping characteristics.
   3. Provide with ground fault protection where indicated on Drawings or as required by NEC.
   4. Operate by a toggle-type handle and quick-make/quick-break over-center switching mechanism that is mechanically trip-free. Clearly indicated automatic tripping of the breaker by the handle position.
   5. Short circuit capacity rating to withstand the maximum short circuit duty that can be expected at the breaker location in the electrical system. Minimum short circuit rating for circuit breaker 10,000 AIC for 120/208V breakers, and 14,000 AIC for 277/480V breakers.
   6. Series rating is not permitted.

7. Provide circuit breakers that are 1200 amp and larger rated or can be adjusted to be 1200 amp or larger rated, with an energy reducing maintenance switch adjustment to meet the requirements of NEC 240.87.
8. Provide LSI adjustable trip setting capability for breakers rated 400 amp and larger.
9. Provide LSIG adjustable trip setting capability for breakers rated 1200 amp and larger.

G. Wiring/Terminations:
1. Small wiring, necessary fuse blocks and terminal blocks within the MDP furnished as required. Control or metering components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
2. Provide mechanical-type terminals for line and load terminations suitable for copper or aluminum cable rated for 167 degrees F of the size as indicated on the Drawings.
3. Provide lugs in the incoming line section for connection of the main grounding conductor and other grounding conductors as indicated on Drawings.

H. Where exposed to weather, provide NEMA Type 3R enclosure with interior thermostatically controlled electrical space heater with adequate wattage to prevent the accumulation of moisture. Obtain power for space heater a control power transformer within the MDP assembly.

I. Surge Protection Device (SPD):
1. Mount in a NEMA Type 1 enclosure external to switchboard equipment.
2. Surge protection uses thermally protected MOV technology.
3. Surge current capacity rating as recommended by manufacturer.
4. Dual-colored protection status indicators for each phase.
5. Dual-colored protection status indicators for the N-G protection mode.
6. Audible alarm with silence button.
7. Form C relay contact.

J. Electronic Customer-Metering:
1. Provide microprocessor based electronic meter to monitor electrical power distribution system in a real time mode. The system consists of a meter and display integral to the MDP in a separate customer-metering compartment with front-hinged door.
2. At a minimum, provide a meter for the incoming electrical service. Where shown on Drawings, provide additional meters for other equipment and feeder devices within Main Distribution Panel.
3. Where multiple meters are required, provide single LCD display capable of accepting inputs from meters shown.
4. Current transformers for each meter wiring to shorting-type terminal blocks within customer metering compartment.
5. Provide potential transformers including primary and secondary fuses with disconnecting means.
6. Accept input from industry standard instrument transformers (120VAC secondary PT's and 5A secondary CT's.)
7. The current and voltage signals digitally sampled at a rate high enough to provide accurate RMS sensing and valid data for waveform analysis beyond the 30th harmonic (fundamental frequency of 60 HZ).
8. Setup parameters required by the meter stored in nonvolatile memory (no battery backup) and retained in the event of a control power interruption.
9. The meter maintains in nonvolatile memory a maximum and minimum value for each of the instantaneous values reported as well as the time and date of the highest peak for peak demand readings.
10. Accurate to +1 percent voltage and current sensing.
11. Minimum readings reported by the meter:
    a. Energy: real (kWh), reactive (kVARh).
    b. Current, per phase RMS +1 percent
    c. Current, 3-phase average RMS +1 percent
    d. Voltage, phase-to-phase and phase-to-neutral +1 percent

e. Power factor, per phase +2 percent
f. Power factor, 3-phase total +2 percent
g. Frequency +0.5 percent

12. The following demand readings reported by the meter:
    a. Average demand current, per phase.
    b. Peak demand current, per phase.
13. Communications: Provide with RS-485 and Modbus RTU output capability.

2.03 SUB-DISTRIBUTION PANELS (SDP)

A. General:
1. Similar in manufacture as the Main Distribution Panel.
2. Freestanding, rear-aligned, front-accessible, group-mounted circuit breaker type, fully enclosed with bussing and hardware provisions for the addition of future circuit breakers. Assemblies rated 800A or below may be wall-mounted.
3. Circuit breaker trip ratings as indicated on Drawings.
4. Equipment assembly has a short circuit current rating (SCCR) greater than the maximum available fault current expected at that point in the distribution system.
5. Listed by Underwriters' Laboratories and bear a UL label.
6. Refer to Drawings for maximum allowable equipment footprint.

B. Construction:
1. Equipment consists of the required number of vertical sections bolted together to form a rigid assembly.
2. Formed edges of front covers or hinged front panels.
3. Provide adequate ventilation within the enclosure.
4. Sections of the equipment rear-aligned with depth as required to accommodate devices shown and necessary conduit entrance for current and future devices.
5. Exterior and interior steel surfaces properly cleaned and provide with a rust-inhibiting coating. Color and finish ANSI 61 light gray.

C. Bus Work:
1. Copper or tin-plated aluminum, sized as indicated, with a 100 percent capacity neutral bus.
2. Bus sizing based on NEMA standard temperature rise criteria of 149 degrees F above an ambient of 104 degrees F under continuous full load current and rated to withstand the maximum available fault current expected at that point in the distribution system.
3. Include bussing provisions for mounting future devices in spaces called for on Drawings. Where panel configuration provides additional spaces within a section, these spaces bussed to receive future devices.
4. Provide a copper ground bus firmly secured to each vertical section and extending the entire length of the SDP.
5. Fully bus vertical sections.

D. Circuit Breakers:
1. Provide main and feeder circuit breakers as shown on Drawings.
2. Molded case, bolt-on type, with inverse time and instantaneous tripping characteristics.
3. Provide with ground fault protection where indicated on Drawings or as required by NEC.
4. Operated by a toggle-type handle and quick-make/quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker clearly indicated by the handle position.
5. Short circuit capacity rating to withstand the maximum short circuit duty that can be expected at the breaker location in the electrical system. Minimum short circuit rating for circuit breaker 10,000 AIC for 120/208V breakers, and 14,000 AIC for 277/480V breakers.
6. Series rating is not permitted.
7. Provide circuit breakers that are 1200 amp and larger rated or can be adjusted to be 1200 amp or larger rated, with an energy reducing maintenance switch adjustment to meet the requirements of NEC 240.87.
8. Provide LSI adjustable trip setting capability for breakers rated 400 amp and larger.

9. Provide LSIG adjustable trip setting capability for breakers rated 1200 amp and larger.

E. Wiring/Terminations:
   1. Small wiring, necessary fuse blocks and terminal blocks within the SDP furnished as required. Control or metering components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
   2. Mechanical-type terminals provided for line and load terminations suitable for copper or aluminum cable rated for 167 degrees F of the size as indicated on the Drawings.
   3. Provide lugs in the incoming line section for connection of the main grounding conductor and other grounding conductors as indicated on Drawings.

F. Where exposed to weather, provide NEMA Type 3R enclosure with interior thermostatically controlled electrical space heater with adequate wattage to prevent the accumulation of moisture. Power for space heater obtained from a control power transformer within the SDP assembly.

G. Surge Protection Device (SPD):
   1. Mount in a NEMA Type 1 enclosure external to SDP equipment.
   2. Use thermally protected MOV technology.
   3. Surge current capacity rated as recommended by manufacturer.
   4. Dual-colored protection status indicators for each phase.
   5. Dual-colored protection status indicators for the N-G protection mode.
   6. Audible alarm with silence button.
   7. Form C relay contact.

H. Electronic Customer-Metering, where shown on Drawings:
   1. Provide microprocessor based electronic meter to monitor electrical power distribution system in a real time mode. The system consists of a meter and display integral to the SDP in a separate customer-metering compartment with front-hinged door.
   2. Where multiple meters are required, provide single LCD display capable of accepting inputs from meters shown.
   3. Current transformers for each meter wiring to shorting-type terminal blocks within customer metering compartment.
   4. Potential transformers including primary and secondary fuses with disconnecting means provided.
   5. The electronic meter accept input from industry standard instrument transformers (120 VAC secondary PT's and 5A secondary CT's.)
   6. The current and voltage signals digitally sampled at a rate high enough to provide accurate RMS sensing and valid data for waveform analysis beyond the 30th harmonic (fundamental frequency of 60 HZ).
   7. Setup parameters required by the meter stored in nonvolatile memory (no battery backup) and retained in the event of a control power interruption.
   8. Maintain in nonvolatile memory a maximum and minimum value for each of the instantaneous values reported as well as the time and date of the highest peak of the peak demand readings.
   9. Accurate to +1 percent voltage and current sensing.
   10. The following minimum readings reported by the meter:
       a. Energy: real (kWh), reactive (kVARh).
       b. Current, per phase RMS +1 percent
       c. Current, 3-phase average RMS +1 percent
       d. Voltage, phase-to-phase and phase-to-neutral +1 percent
       e. Power factor, per phase +2 percent
       f. Power factor, 3-phase total +2 percent
       g. Frequency +0.5 percent
   11. The following demand readings reported by the meter:
       a. Average demand current, per phase.
       b. Peak demand current, per phase.
   12. Communications: Provide with RS-485 and Modbus RTU output capability.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the distribution system assemblies and equipment as shown on the Drawings, parallel and square with the building lines.

B. Attach distribution equipment to building structure; refer to Section 26 0529, Hangers and Supports for Electrical Systems.

C. Neatly lace and secure the conductors of the feeder circuits individually at maximum 2-foot intervals. Cable lugs not to support the weight of the cables.

D. Where fusible distribution panels are provided, mount a spare fuse cabinet adjacent to each fusible distribution panel. Equip cabinet with one complete set of spare fuses of each size and type installed in the panel with appropriate fuse pullers.

E. Concrete Pads: Provide minimum 3.5-inch thick concrete housekeeping pads under freestanding pieces of distribution equipment. Pads extend a minimum of 2-inches beyond the edges of the equipment.

F. Adjust breaker settings per recommendation of coordination study and test ground fault settings as required by NEC.

G. Equipment Tests:
   1. Provide acceptance testing for equipment in accordance with NETA Acceptance Testing Specifications. Record results and submit with final warranty.
   2. Where ground fault protection is provided, perform tests on the ground fault protection system in accordance with the manufacturer's instructions. Record results and submit with final warranty.
   3. If tested equipment is found defective during testing sequence, replace it without additional cost to the Owner. Test replaced equipment until satisfactory results are obtained.
   4. Where included, refer to Section 26 0580, Electrical Testing for additional requirements.

H. Cleaning: Upon completion of installation, inspect interior and exterior of distribution equipment. Remove paint splatters or other spots. Vacuum dirt and debris; do not use compressed air to clean. Repair exposed surface to match original finish.

END OF SECTION

SECTION 26 2416
PANELBOARDS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Branch Panelboards
   2. Identification

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0533, Raceways and Boxes for Electrical Systems

F. Section 26 0553, Identification for Electrical Systems

G. Section 26 0573, Overcurrent Protective Device Coordination Study

H. Section 26 0580, Electrical Testing

I. Section 26 4313, Surge Protective Devices

1.03 SUBMITTALS

A. Shop Drawings

B. Product Data
   1. Detailed component material list.
   2. Voltage rating, amperage rating, bussing material, fault rating, wiring lugs capacity, mounting method, physical size, exterior finish and options.
   3. Individual circuit breaker product data sheets.
   4. Panel schedules indicate circuit breakers in the same orientation as the construction documents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panelboards use the same manufacturer as the distribution equipment specified in Section 26 24 13, Switchboards.

2.02 BRANCH PANELBOARDS

A. Branch Circuit Panels:
   1. Bolt-on circuit breaker type fitted with metallic flush lift latches and locks keyed alike.
   2. Deliver panel keys to the Owner at completion of the project.

B. Short Circuit Current Rating (SCCR):
   1. Fully rated at a value greater than the maximum available short circuit current that can be expected at the panelboard location in the electrical system.
   2. Series rating is not permitted.

C. Cabinets:
   1. Cabinet rough-in boxes code gauge steel, with dead front covers.
   2. Flush panels have flush doors with concealed hinges and mounting clamps.
   3. Surface panels have metal face trims with no sharp edges or corners.
   4. Surface panel cabinets fabricated without knockouts and finished to match face trim.
   5. Panels have door in door hinged trim fronts that provides full access to wiring compartment.

D. Wiring Gutters:
   1. Minimum of 4-inches wide except where feeder conductors enter where a minimum of 6-inches clear.
   2. Feeder conductors to enter directly in line with lug terminals wherever practicable.
   3. Provide separate feeder studs for each feeder conductor compression lug.

E. Bussing:
   1. Provide one continuous bus bar per phase.
   2. Provide copper or electrical grade aluminum alloy sized as indicated on the drawings and in accordance with UL standards to limit temperature rise on current carrying part to a maximum of 149 degrees F above an ambient temperature of 104 degrees F maximum.
   3. Full size insulated neutral bars included for panels indicated to have a neutral.
   4. Bus bar taps for panels with single pole branches arranged for sequence phasing of the branch circuit devices.

F. Ground Bus: Provide in each panelboard and include the following:
   1. Have the same rating as the neutral bus.
   2. Contain a ground conductor terminal for each available circuit in the panelboard.
   3. Size terminals for branch circuit equipment grounding conductors.

G. Isolated Ground Bus: Provide in each panelboard as indicated and included the following:
   1. Insulate from the panelboard enclosure.
   2. Same rating as the neutral bus.
   3. Contain a ground conductor terminal for each available circuit in the panelboard.
   4. Have terminals sized for the branch circuit equipment grounding conductors.

H. Interiors:
   1. Main lug only unless otherwise indicated, with dead front shield covering the bus, and bus connectors, with mounting hardware and bussing for spaces indicated for future installation of devices.
   2. Dead front construction for interior trim.
   3. Cover unused mounting spaces with preformed knockouts.

I. Main Circuit Breaker:
   1. Where indicated, equip panels indicated with main circuit breakers sized as scheduled and mounted behind door at top of panel for top entrance feeders, and bottom of panel for bottom entrance feeders.
   2. Where main circuit breaker size is not indicated, ampere rating match feeder ampacity, or panelboard rating, whichever is less.
      a. Molded case, thermal magnetic bolt-on type and sized as indicated on the Drawings. Circuit breaker have an over center, trip-free, toggle mechanism that provide quick-make, quick-break contact action. Indicate open, closed, or tripped by handle position, with common internal trip crossbar to provide simultaneous tripping for poles.
      b. Circuit breakers have a permanent trip action with thermal and magnetic trip elements in each pole. Each thermal element factory calibrated to operate in a 104 degrees F ambient environment. Thermal elements ambient compensating above 104 degrees F.
      c. Provide the main circuit breaker with a padlock-able lock-off device to provide capability to be locked in the open position.

J. Branch Circuit Breakers:
   1. Provide with amperage rating, and number of poles as indicated in the Panelboard Schedules.
   2. Bolt-on type circuit breakers.
   3. Over center toggle mechanism that provide quick-make, quick-break contact action. Circuit breakers have thermal and magnetic trip elements in each pole. Two and three pole circuit breakers have an internal common trip crossbar to provide simultaneous tripping.

4. Exposed faceplates of circuit breakers flush with one another.
5. Short circuit capacity rating to withstand the maximum short circuit duty that can be expected at the breaker location in the electrical system. Minimum short circuit rating for circuit breakers: 10,000 AIC for 120V and 208V breakers, 14,000 AIC for 277V and 480V breakers.
6. Circuit breakers used for switching duty UL listed for that purpose and marked SWD.
7. Provide each branch circuit breaker with a factory padlock-able lock-off provisions.

K. Provide shunt trips, alarms, and auxiliary switches as shown on the Drawings.

L. Provide Arc Fault Circuit Interrupter (AFCI) breakers as shown on the Drawings or as required by Code.

M. Provide Ground Fault Interrupter (GFI) Circuit breakers as shown on the drawings or as required by Code. GFI breakers serving heat trace circuits 30 ma ground fault trip rating.

N. Surge Protective Device (SPD): Provide an integral or separate SPD with panelboards that are part of an emergency NEC 700 required system. Refer to Section 26 4313, Surge Protective Devices for requirements.

2.03 IDENTIFICATION

A. Identify branch circuit breakers with individual circuit numbers adjacent to each breaker with a typewritten card to identify the load controlled by that breaker.

B. Provided with complete schedules of panelboards as designed prior to start of construction. Schedules will include circuit breaker arrangement, load schedules, and ratings for use in identification of circuits and coordination.

C. Refer to Section 26 0553, Identification of Electrical Systems for additional requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with manufacturer's recommendations.

B. Install panelboards plumb and level, located as shown on the Drawings up 6-feet – 6-inches to top unless noted otherwise.

C. Keep area above panelboard clear of equipment foreign to the electrical installation. Coordinate installation with other trades.

D. Provide identification and panel schedules as specified in Section 26 0553, Identification of Electrical Systems.

E. Provide the required SPD and associated overcurrent device for emergency NEC 700 systems, install per manufacturers recommendations.

3.02 SPARE CONDUITS

A. Install a spare 3/4-inch conduit from flush panels for each three single pole breakers or spaces provided. Terminate conduits above accessible ceiling or as directed.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Line Voltage Wall Switches
   2. Receptacles
   3. Plates

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0533, Raceways and Boxes for Electrical Systems

F. Section 26 0553, Identification for Electrical Systems

G. Section 26 0580, Electrical Testing

H. Section 26 0923, Lighting Control Devices

1.03 SUBMITTALS

A. Product Data

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Line Voltage Wall Switches:
   1. Hubbell
   2. Leviton
   3. Arrow-Hart
   4. Pass & Seymour

B. Receptacles:
   1. Use same manufacture as the Line Voltage Wall Switches.
   2. Hubbell
   3. Leviton
   4. Arrow-Hart
   5. Pass & Seymour

C. Plates:
   1. Hubbell
   2. Leviton
   3. Arrow-Hart
   4. Pass & Seymour

2.02 MATERIALS

A. Extra heavy duty grade wiring devices, with special devices as noted on the Drawings. Should the Drawings indicate a device other than those listed. Device of same grade and manufacture as specified below. Furnish a matching plug connector for special purpose devices that do not have the common 120V NEMA 5-20R configuration.

B. Lighting switches and duplex receptacles installed have similar appearance characteristics unless noted otherwise.

2.03 LINE VOLTAGE WALL SWITCHES

A. Line Voltage Switches:
   1. 20A rated, 277V, quiet type, extra heavy duty, heavy duty nylon toggle handle, back, and side wired with screw terminal connections.
   2. As noted on the drawings provide:
      a. Pilot light switch: lighted clear toggle.
      b. Momentary Contact Switches: 15A, SPDT, center off.
      c. Key Switches: 20A, 277V, back and side wired with screw terminal connections.

B. EPO Pushbutton Switch:
   1. Red mushroom head push-off, pull-on with concentric guard, 2-1/4 inch diameter, non-illuminated, heavy duty operator.
   2. Provide clear hinged louver to prevent accidental operation.
   3. Provide laminated engraved nameplate attached with stainless steel screws indicating Emergency Power Off and load served.

C. Except as noted herein, device exposed finish color as follows:
   1. Normal Power: as selected by Architect.
   2. Emergency Power: Red
   3. Standby Power: Red

2.04 RECEPTACLES

A. Standard Straight Blade Duplex Receptacle:
   1. 3-wire, 2-pole with grounding, extra heavy duty, 20A rated, NEMA 5-20R configuration, back and side wired with screw terminal connections.
      a. Provide hospital grade in patient care areas as required by NEC.
      b. Provide tamper-resistant as noted on the drawings or NEC required.
      c. Provide isolated ground as noted on the drawings or NEC required.
      d. Provide surge suppression receptacles as noted on the drawings.
      e. Provide controlled receptacles with permanent marking as required by NEC.
   2. Ground Fault Interrupting straight blade duplex receptacle:
      a. Heavy duty, 3-wire, 2 pole with grounding, self-testing, green “ON” LED to indicate power, red “ON” LED to indicate ground fault condition, 20A rated, NEMA 5-20R configuration, back and side wired with screw terminal connections.
         1) Provide hospital grade in patient care areas as required by NEC.
         2) Provide tamper-resistant as noted on the drawings or where NEC required.
         3) Provide weather-resistant rating at exterior locations as required by NEC.

B. Clock Outlets: As noted on the drawings and compatible with the specified clock system.

C. Special Purpose Receptacles: As noted on Drawings with NEMA configurations.

D. Exposed Device Color, unless otherwise noted, is as follows:
   1. Normal power: Gray or as selected by Architect.

2.05 PLATES

A. Flush Finish Plates:
   1. Coordinated with Architect.
   2. 0.04-inch thick, Type 302 stainless steel, brush finish.

B. Surface Covers:
   1. Galvanized or cadmium plated steel, 1/2-inch raised industrial type with openings appropriate for device installed.

C. Weatherproof:
   1. Extra-Duty while in use covers, UL 514D listed, commercial quality die cast aluminum construction, NEMA 3R rated, gasketed, built-in padlock provisions, built-in cord strain relief provisions, gray powder-coated finish, vertical mounting as required for application or other covers of similar construction for other receptacle configurations.

D. Identification:
   1. Identify receptacle plates with a pre-printed label indicating serving panel and branch circuit number.
   2. Refer to Section 26 0553, Identification for Electrical Systems.

PART 3 EXECUTION

3.01 INSTALLATION

A. Devices and finish plates installed plumb with building lines. Install wall mounted receptacles vertically at centerline height shown on the Drawings.

B. Finish plates and devices are not installed until final painting is complete. Scratched or splattered finish plates and devices will not be accepted.

C. Switches, receptacles and/or other devices ganged into a common enclosure provided with a separation barrier between devices where the combined circuit voltages within the enclosure exceeds 300V.

D. Provide GFCI receptacles as shown on the drawings or as NEC required. Provide a GFCI type duplex receptacle in each required location, do not sub-feed normal receptacles downstream of the GFCI receptacle to obtain the GFCI rating.

E. Provide receptacles with GFCI, tamperproof, weather-resistant or hospital grade ratings as shown on the drawings, appropriate for the installation or required by NEC.

3.02 CORD CAPS

A. Special plugs provided with the receptacles given to the Owner in their cartons with a letter stating the date and the Owner's representative that received the materials.

3.03 COORDINATION

A. Electrical Drawings indicate the approximate location of devices. Refer to Architectural elevations, sections, and details for exact locations.

B. Coordinate with equipment installer the locations and methods of connection to devices mounted in cabinets, counters, work benches, service pedestals, and similar equipment.

3.04 TESTING

A. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct defective wiring.

END OF SECTION

SECTION 26 2900
MOTOR CONTROLLERS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Motor Control Centers
   2. Motor Starters
   3. Disconnects
   4. Fuses
   5. Power Module (Elevator Shunt Trip)

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cable

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0553, Identification for Electrical Systems

F. Section 26 0573, Overcurrent Protective Device Coordination Study

G. Section 26 0580, Electrical Testing

1.03 SUBMITTALS

A. Shop drawings, including the following information.
   1. Field Dimensions
   2. Description of Materials and Finishes
   3. Component Connections
   4. Anchorage Methods.
   5. Installation Procedures

B. Product Data

C. Operating and Maintenance Data

D. Overload (Heater) Sizing: A final listing of motors and the heater size installed for that motor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Motor Control Centers, Motor Starters and Visible Blade Disconnects:
   1. Same manufacture as the distribution equipment specified in Section 26 2413, Switchboards.
   2. Allen Bradley
   3. Or approved equivalent.

B. Horsepower Rated Toggle Switches:
   1. Arrow Hart
   2. General Electric
   3. Hubbell
   4. Pass & Seymour

2.02 GENERAL

A. Provide manual or magnetic motor starters of the proper characteristics for equipment as indicated.

B. Provide motor control centers as indicated.

C. Provide switches of proper characteristics as disconnecting means.

2.03 MOTOR STARTERS

A. Manual Starters:
   1. NEMA ICS 2, AC general purpose Class A manually operated toggle type full voltage controller for fractional horsepower induction motors, quick-make, quick-break, with thermal overload protection and suitable enclosures.

B. Magnetic Starters, Non-reversing:
   1. NEMA ICS 2, AC general purpose, full voltage across the line non-reversing type, 120V coils, overload relays in each leg, running pilot lights, one normally closed and one normally open auxiliary contacts, 120V control transformers and suitable enclosures.
   2. Overload relays ambient compensated bimetallic type with interchangeable heater pacts.
   3. Overload adjustable, have single-phase sensitivity, and manual or automatic reset.
   4. Suitable for the addition of at least four auxiliary contacts of arrangement normally open or normally closed.
   5. Provide with a NO and a NC auxiliary contacts.
   6. Minimum fault interrupting rating of 10,000A.

C. Magnetic Starters, Reversing:
   1. NEMA ICS 2, AC general purpose.
   2. Reversing starters consist of two contactors and a single overload relays assembly.
   3. Include electrical interlock and integral adjustable time delay transition between FORWARD and REVERSE rotation.
   4. Starters electrically and mechanically interlocked to prohibit line shorts and both starters being energized simultaneously.

D. Magnetic Starters, Two Speed:
   1. NEMA ICS 2, AC general purpose.
   2. Include electrical interlock and integral adjustable time delay transition between SLOW and FAST speeds.
   3. Electrically and mechanically interlocked to prohibit both starters being energized simultaneously.

E. Combination Starter/Disconnect, (Circuit Breaker):
   1. Combine magnetic motor starter as described above and thermal magnetic circuit breaker disconnect in a common enclosure.

F. Motor Circuit Protector:
   1. NEMA AB 1, circuit breaker with integral instantaneous magnetic trip in each pole.
   2. Externally operated handle, giving positive visual indication of its ON-OFF position.

G. Thermal Magnetic Circuit Breaker:
   1. NEMA AB 1, with integral thermal and instantaneous magnetic trip in each pole.
   2. Circuit protector externally operated handle, giving positive visual indication of its ON-OFF position.

H. Combination Starter/Disconnect, Disconnect Switch Type:
   1. Combine magnetic motor starter as described above and non-fused or fused disconnect switch in a common enclosure. Switch type as indicated on the drawings. Switch has an externally operated handle that gives positive visual indication of its ON-OFF position.
   2. Non-fused Switch Assemblies:
      a. NEMA KS 1, enclosed knife switch with enclosed, but visible blades. Switch rated as indicated on the drawings.
   3. Fused Switch Assemblies:
      a. NEMA KS 1, enclosed knife switch. Fuse clips accept Class R fuses. Switch and fuse sizes as indicated on the drawings.

I. Starter Contacts:
   1. Totally enclosed, double break, silver-cadmium-oxide power contacts.
   2. Contact inspection or replacement possible without disturbing line or load wiring.

J. Overload Relay:
   1. NEMA ICS with one-piece thermal unit construction.
   2. Interchangeable thermal units.
   3. Replaceable overload relay control circuit contact.
   4. Thermal units required for starter to operate.

K. Enclosure:
   1. NSI/NEMA ICS 6, Type 1 as indicated, or as required to meet the conditions of installation.

L. Equip starters with H-O-A selector switches, start-stop stations, or other auxiliary control device listed. Where no auxiliary devices are listed, equip each starter with an H-O-A switch.

M. Provide a control circuit transformer in each starter. Size transformer to accommodate the contactor(s) and control circuit loads. Include primary and secondary fuses in ungrounded conductors.
   1. Provide one normally open and one normally closed auxiliary contacts in each starter, unless additional auxiliary contacts are required. NEMA ICS 2.

N. Provide starter units with control terminal blocks. Terminal blocks rated at 20-Amperes and accessible from inside the unit with the unit door is opened.

O. Push Buttons: Unguarded, recessed type

P. Indicating Lights, LED type:
   1. Green for run.
   2. Red for stopped unless otherwise indicated.

2.04 DISCONNECTS

A. Safety and disconnect switches NEMA type HD (heavy duty), quick-make, quick-break, dual rated with electrical characteristics as required by the system voltage and the load served. Equip switches with defeatable cover interlock.

B. Enclosures NEMA l for indoor use, unless specifically noted otherwise and NEMA 3R where installed exposed to the weather or designated by the subscript WP.

C. Fusible or non-fusible as designated on Drawings.

2.05 FUSES

A. UL Class RK-5 dual element, time delay, current limiting type. The overload thermal time delay element spring actuated soldered copper assembly in a separate sand free compartment. The short circuit current limiting section copper alloy links encased in quartz sand.

B. Capable of holding 500 percent of rated current for a minimum of 10 seconds, and carry a UL listed minimum interrupting rating of 200,000A rms symmetrical.

2.06 POWER MODULE (ELEVATOR SHUNT TRIP)

A. Motor rated, fused power switch (size as indicated on drawings) with integral shunt trip attachment, control power transformer, control power fuses and blocks, fuse covers, key to test, pilot lights and fire alarm interface relay to NEMA I enclosure for emergency shutdown of elevator power. Provide auxiliary contacts for elevator battery lowering device to sense if power module was manually or unintentionally turned-off.

B. Manufacturers:
   1. Bussmann PS Series
   2. Littelfuse
   3. Ferrazshaw-Mersen
   4. Or approved.

PART 3 EXECUTION

3.01 MOTOR STARTERS

A. Provide the motor starting equipment as shown on the Drawings and coordinate motor overload starter relays.

B. Install the starters at the respective equipment unless shown otherwise.

C. Install freestanding starters on metal channel support structure.

D. Starters that are installed on exterior walls installed with minimum 1/2-inch channel on wall to allow air space between starter and wall.

E. Where fusible units are provided, install fuses as indicated on the drawings.

F. Install thermal overloads (heaters) in each starter in accordance with the manufacturer's recommendations for that motor and the type of associated load. Coordinate proper size when individual power factor capacitors are utilized at the motor.

3.02 DISCONNECT SWITCHES

A. Provide code required disconnect switches under this work.

B. Non-fusible disconnect switches required when equipment is not in sight of the branch circuit panel or starter may be horsepower rated, toggle type in suitable enclosure, mounted at or on the equipment.

3.03 MOTOR CONTROL CENTERS

A. Install motor control centers parallel with structural building line. Sections fit neatly without gaps, openings, or distortions. Install level and plumb sections.

B. Seismic Restraint:
   1. Provide seismic restraint for electrical equipment as recommended by SMACNA.
   2. Provide shop drawings sealed by a registered Structural Engineer indicating this seismic restraint.

C. Securely tie wiring at intervals not to exceed two feet in wireways.

D. Arrange conduits and raceways entering the assemblies to avoid obstruction of the wireways. Conduits enter the assembly close to the associated starter section, avoiding crisscrossing and congestion in the wireways.

E. Provide a nominally 2-inch deep concrete pad for motor control centers.

F. Identification on each starter and motor control center provided as specified in Section 26 0553, Identification for Electrical Systems and as indicated in this section.

3.04 FUSES

A. Install fuses for motor protection to best protect the motor without nuisance tripping. Should fuse sizes require changing from what is shown due to variance between the original design information and actual equipment installed, fuses sized in accordance with NEC. Do not size fuses smaller than the starter heaters on motor circuits.

B. Provide one complete set of spare fuses of each amperage used on this project. Store spare fuses in the spare fuse cabinet.

3.05 COORDINATION

A. Verify the characteristics and the motor full load current for each motor installed, using the actual motor nameplate data. Select and install the proper running overload devices in the starter as per the manufacturer's instructions. Provide the proper overload protection is a part of this Division of the work.

B. Prepare table of motor full load currents and installed overload devices and submit to the Architect.

END OF SECTION

SECTION 26 3213
ENGINE GENERATORS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Diesel Engine
   2. Engine Starting System
   3. Generator and Exciter
   4. Instruments and Controls
   5. Remote Annunciator
   6. Remote Emergency Stop
   7. Automatic Operation
   8. Weatherproof Housing
   9. Consist of a natural gas engine driven electric generator set with control panel, cooling system, governor, starter motor, structural steel skid base and other accessories needed for proper operation, including exhaust system, automatic battery charger, starting batteries, battery cables, and other accessories as required for operation as specified below. The complete system is intended to automatically provide continuous electric power for the duration of any failure of the normal utility electric supply.
   10. Minimum standby output rating of 200 KW with 0.8 power factor, 480Y/277V, 3-phase, 4-wire, 60 Hertz, AC.

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0553, Identification for Electrical Systems

F. Section 26 0573, Overcurrent Protective Device Coordination Study

G. Section 26 0580, Electrical Testing

1.03 QUALITY ASSURANCE

A. Engine Generator Set: Product of a firm regularly engaged in the assembly or manufacture of this equipment.

B. Component Parts: Product of firms regularly engaged in the manufacture of these parts.

C. It is the intention of these specifications to secure equipment that can be properly maintained and serviced without the necessity of carrying expensive parts, stocks or being subjected to the inconvenience of interrupted service due to the lack of available parts.

D. An engine of the same model, bore, stroke, configuration, and rpm as the engine submitted.

E. Minimum of 2,000 hours of satisfactory operation under average rated load conditions of 75 percent or greater over a 2 year period.

F. Satisfactory operation is defined as an availability of at least 95 percent with no period of downtime for repair in excess of 75 hours.

G. Provide certification of the above equipment experience, either from field installations or laboratory testing.

H. Provide NEMA certification so the generator meets applicable NEMA standards.

I. Include certifications with the shop drawing submittal.

1.04 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. UL: Underwriters Laboratories
      a. UL 508 Industrial Control Equipment
      b. UL 1008 Automatic Transfer Switches
   2. NFPA: National Fire Protection Association
      a. NFPA 30 Flammables and Combustible Liquids
      b. NFPA 37 Stationary Combustion Engines and Gas Turbines
      c. NFPA 70 National Electrical Code (NEC)
      d. NFPA 110 Emergency and Standby Power Systems
   3. NEMA: National Electrical Manufacturer's Association
      a. NEMA ICS Industrial Controls and Systems
      b. NEMA MG-1 Motors and Generators

1.05 SUBMITTALS

A. Shop Drawings

B. Product Data

C. Site Test Report

D. Operating and Maintenance Data:
   1. Provide complete instructions covering the operation and testing of the engine generator and associated equipment for the plant, together with a manual covering engine operation and maintenance. Operation instructions to include minor adjustments necessary to obtain optimum operation of the set.
   2. Maintenance instructions to include complete trouble shooting and diagnostic information, disassembly instructions, assembly instructions and preventive maintenance schedule.
   3. Preventive maintenance schedule to be in outline form. Include recommended lubricants and specified necessary service checks. Furnish spare parts books for the engine generator and associated equipment.
   4. Include data in Operating and Maintenance Manuals specified in Section 26 0500, Common Work Results for Electrical.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Caterpillar

B. Cummins

C. Generac

D. MTU Onsite Energy

E. Kohler

2.02 DIESEL ENGINE

A. Natural gas-fueled, liquid-cooled, four cycle, multi-cylinder, mechanical injection type.

B. Naturally aspirated, supercharged, turbo-charged or turbo-charged-after-cooled. Fuel pump has minimum 5-foot suction lift at operating speed. Provide engine with removable cylinder liners of the wet or dry type.

C. Equip with the following accessories:
   1. Pressurized lubricating system and a full flow filter system consisting of a strainer with openings not exceeding 0.035-inches, followed by a replaceable filter capable of removing 15 micron particles.

2. Air cleaner to effectively remove dirt and abrasives from the combustion air. Arrange filter for easy removal and replacement of filter element. A combination filter silencer or separate silencer provided if required on the intake air system to reduce the intake air noise level below the audible mechanical noise level of the engine.
3. Isochronous type governor to produce the following characteristics: Steady state speed bank, ±1/3 percent; frequency change with 25 percent and load change, 2 percent; recovery time for 25 percent load change, 3 seconds; speed change for 100 percent load rejection, 8 percent. Provide engine with an independent over speed governing system actuated to stop the engine when speed exceeds 120 percent of synchronous speed. Over speed shutoff device requires manual resetting after emergency tripping.
4. Size direct mounted radiator to maintain engine coolant at recommended temperature during engine operation at full load. Horizontal discharge radiator, with fan driven directly from the engine crankshaft or through V-belt drive. Fan to have sufficient pressure to circulate the required quantity of air for engine cooling through an outside air louver with 0.5-inch pressure drop. Enclose fan assembly with a suitable guard.
5. Provide cooling system with thermo-statically controlled radiator shutters and thermostats, as required to maintain proper engine operating temperature. Design filler caps for pressure relief prior to removal. Hoses and connections suitable for temperatures up to 275 degrees F and a working pressure of 100 psig. An engine-driven pump provided for circulating jacket coolant. Provide cooling system with a permanent type antifreeze solution containing a rust inhibitor. Use type of antifreeze solution as recommended by the engine manufacturer.
6. Thermostatically controlled electric water heater to supply heat to the engine water jacket. The heater to have sufficient capacity to maintain the engine jacket coolant at a temperature of 90 degrees F. Install heater in such a manner that rapid thermal circulation is obtained with minimum temperature differential between the heater-water and cylinder head water.
7. Locate critical type exhaust muffler as close to the engine as practicable. Sound levels at 23-feet from the engine no more than 70 DBA. Provide muffler with bolted flange connections and companion flanges. Pressure drop through the muffler not to exceed the recommendations of the engine manufacturer. Provide a bellows type flexible connection 24-inch length at the engine exhaust. Construct bellows of flexible connections of 321 stainless steel and provided with bolted flanged ends. Muffler and indoor exhaust piping insulated with lagging to maintain a surface temperature not to exceed 150 degrees F. Lagging not to interfere with operation of flexible connection. Black steel exhaust piping conforming to Federal Specification WW-P-406D, Weight A, Class 1. Pitch exhaust piping be pitched away from the engine.
8. Provide the following automatic engine protective systems with a single audible alarm and separate fault indicating lights mounted in the engine generator control panel:
    a. High coolant temperature shutdown.
    b. Low oil pressure shutdown.
    c. Engine over speed shutdown.
    d. Engine over crank shutdown.
    e. Silencing switch with ring back feature for audible alarm. Fault indicating lights remains ON as long as the faults are uncorrected. Provide lamp test switch.

D. Mount engine-generator set on a structural steel subbase and provide suitable spring-type vibration isolators. Provide isolator with an operating efficiency greater than 90 percent. Provide welded floor plates on isolators and bolt to concrete floor to provide lateral restraint.

2.03 ENGINE STARTING SYSTEM

A. Provide a DC electric starting motor integral with the engine and solenoid of required voltage and amperage as recommended by the engine manufacturer. The drive mechanism for engaging the starting motor with the engine flywheel designed to engage and release without binding.

B. Heavy duty, lead acid type storage batteries for engine starting and other requirements. Batters have sufficient capacity to perform not less than four successive 10 second starting attempts without recharging. Voltage as required by the engine starting system. Provide battery rack, cable, cable rack, conduit, electrical wiring, and accessories as required to interconnect the batteries to the DC apparatus.

C. Provide battery charger apparatus to maintain batteries at full charge. This apparatus permits either high or low rate charge, depending on battery condition. Provide an ammeter to indicate charging rate and the charging circuit protected by either fuses or circuit breakers. Protect charger apparatus against damage during engine cranking.

D. Low battery voltage, high battery voltage and charger failure indication initiates alarms at the remote annunciator as a charger malfunction indication.

2.04 GENERATOR AND EXCITER

A. Generator:
   1. Drip proof construction, engine driven self-excited type, directly connected to the engine with a flexible coupling.
   2. Provided with a full amortisseur winding.
   3. Insulation system Class F with temperature rises in accordance with NEMA Standard MG1.
   4. Conform to applicable portions of NEMA Standards for Motors and Generators, MG1.
   5. Include a static voltage regulator, factory tested with the generator to assure proper operation of the generator voltage regulator system.
   6. Maintain output voltage within ±2 percent of rated voltage under steady-state conditions of load between no load and full load.
   7. Recover output voltage within ±2 percent of the final voltage in 2 seconds or less following the sudden application or removal of 25 percent increments of rated load.

B. Exciter:
   1. Brushless direct connected AC exciter used with rotating rectifiers or static exciter regulator assembly.
   2. Consist of an alternator and hermetically sealed rectifiers mounted on the same shaft with the generator.
   3. Feed output of the alternator exciter through the rectifiers to the field of the generator without external electrical connections to the rotating assembly.
   4. Static exciter installed in a suitable enclosure consists of a system of transformers, reactors, semiconductors and other static devices which feedback a part of the generator power output to the generator field for excitation.

C. Automatic Voltage Regulator:
   1. Include a manual voltage adjust control which will provide control of the terminal voltage with ±5 percent of the rated value for any load within the generator rating.

2.05 INSTRUMENTS AND CONTROLS

A. Furnish and install the following engine and generator instruments and controls in a control panel mounted on the engine generator set:
   1. Lube Oil Pressure Gauge
   2. Water Temperature Gauge
   3. Engine Running Time Hour Meter
   4. Manual Start/Stop Switch
   5. Engine Protective Alarms
   6. AC Voltmeter
   7. AC Ammeter
   8. Phase selector switches for voltmeter and ammeter.
   9. Frequency Meter
   10. Voltage Adjust Control
   11. Emergency stop pushbutton station

B. The governor manual speed adjusting control may be either mechanical or electrical. Isolate instrumentation to prevent damage from engine generator set vibration.

C. Provide a panel at the Fireman's Command Center for status indication and control of the generator. Status indication includes a white pilot light indicating generator running, a green pilot indicating generator on-line and a common amber light indicating a generator alarm condition. Provide a guarded generator start switch.

2.06 REMOTE ANNUNCIATOR

A. Provide a remote annunciator. Include the following indicating lights:
   1. Generator On Line
   2. Battery Charger Malfunction
   3. Low Lube Oil Pressure
   4. Low Coolant Temperature
   5. High Coolant Temperature
   6. Engine Over Crank Shutdown
   7. Engine Over Speed Shutdown

B. Include an audible alarm to sound when any of the alarm conditions in this Section exist. Equip audible alarm with a silencing switch with ring back feature.

C. Indicating lights remain ON as long as faults are uncorrected. Equip lights with lamp test device.

D. Derive remote annunciator device power from the engine starting battery/charger system.

2.07 REMOTE EMERGENCY STOP STATION

A. Provide a 2-1/2-inch red, mushroom style remote emergency stop pushbutton station with a hinged clear lift up protective cover.

2.08 AUTOMATIC OPERATION

A. Equip engine generator set with an automatic control system to start and stop the unit. The automatic engine starting control operates from auxiliary contacts in the automatic transfer switch which close for engine run and open for engine stop. Arrange starting control circuits so that cranking will commence immediately after closing of the auxiliary contact. Provide four cranking cycles of 10 seconds ON and 10 seconds OFF. If the engine has not started and the completion of the four cranking cycles, or if any safety device should operate while the engine is in operation, stop unit immediately and the starting controls locked out, requiring manual resetting. The starting control equipment capable of operating at 75 percent normal DC voltage. The over crank indicating light indicates that the engine has not started at the completion of the four cranking cycles. After the engine successfully starts, the starting control automatically disconnect the cranking controls.

B. Selector switch provides the following positions:
   1. Manual or Hand crank
   2. OFF or Stop
   3. Automatic
   4. Engine Test

2.09 WEATHERPROOF HOUSING

A. Provide a weatherproof housing which completely enclose the engine-generator set. Provide weatherproof housing with noise abatement insulation. Quiet type housing attenuate generator noise emission to 70 - 72dBa at 7 meters. Housing contains louvers and controls to automatically open upon engine start-up and close after shutdown. Engine silencer installed inside of the enclosure.

B. Lockable and removable side panels for servicing of the engine-generator. Provide two sets of keys to the owner at completion of the project. Housing have baked enamel finish in color as selected by Architect.

C. Provide two 12VDC luminaires with switch on control panel to light the engine-alternator for use in maintaining the generator set. Connect to engine starting system. Include overcurrent protection for the luminaire circuit.

D. Provide one weatherproof GFCI 20A duplex receptacle mounted to skid base for connection to 120V field wiring.

PART 3 EXECUTION

3.01 ELECTRICAL WIRING

A. Conduit, wiring, and electrical connections required between the various items of the System provided and installed complete.

B. Locate the remote annunciator station and remote emergency pushbutton station as shown on the plans.

3.02 SUPERVISION

A. Installation and start-up supervised, checked, and tested by a qualified representative of the engine generator manufacturer.

3.03 FIELD TEST

A. After installation and initial start-up of the engine generator set is complete, a test performed and logged in the presence of the Architect. Engine generator manufacturer to furnish an engineer to operate the engine during the tests, to check details of the installation and to instruct the operators. This engineer will be required for a period of not less than 2 days for instruction and tests and costs in connection included in the Contractor's bid. Furnish lubricants, load banks, and instruments necessary to conduct the tests and connect devices required to obtain data required below. Connect resistor load bank to load side of the automatic transfer switch and make any necessary temporary connections to obtain full load for the test.

B. Field Test Requirements:

1. Record data every 15 minutes and at the beginning and end of every separate test and include electrical and temperature information. Accomplish testing in the following sequence:
    a. Check engine and generator mounting bolts. Check alignment of engine generator and realign if not within manufacturer's limits.
    b. Test generator and exciter insulation resistance with a megger. Take generator readings at circuit breaker or at leads to switchboard. Record results in the test report.
    c. Perform engine manufacturer's recommended prestarting checks. Include a check of water, fuel and lube oil levels within the engine.
    d. Start engine and make engine manufacturers after starting checks during a reasonable run-in or warmup period.
    e. Operate engine generator set for one hour at 50 percent of rated load.
    f. Operate engine generator set for one hour at 75 percent of rated load.
    g. Operate engine generator set for two hours at 100 percent of rated load.
    h. Measure sound level to assure that the sound spectrum does not exceed the criteria specified.
    i. Increase engine speed by manually overriding the governor. Measure speed by a tachometer. Record speed at which over speed trip operates.
    j. Demonstrate functioning of high temperature coolant circuit by restricting airflow through the radiator.
    k. Shutdown engine and observe operation of low oil pressure control. Record pressure at which trip operates. If safety conditions of the Safety System are not met during the preceding three steps, make the necessary readjustments and step repeated until satisfactory results are obtained.
    l. Ensure proper operation of the automatic exercising system by setting system for automatic operation then manually initiating an exercise period of at least 30 minutes.

m. Battery starting test performed with the charger disconnected, consisting of four cranking cycles of 10 seconds ON and 10 seconds OFF. Shutoff engine fuel supply to prevent starting.

C. Checks to be made during on-site testing:
   1. Proper operation of controls.
   2. Proper operation of gauges and instruments throughout operation.
   3. Proper operation of auxiliary and accessory equipment. Check valves, including pilot valves and injection pump, tests to assure proper operation.

D. Inspection: Upon completion of the on-site tests, a general inspection made for:
   1. Leaks in the engine, piping systems, tanks, etc.
   2. Excessive blowby.
   3. Any other deficiency which may impair proper operation.

3.04 ACCEPTANCE

A. Final acceptance made when the generator set has successfully completed the onsite tests and after defects in material or operation has been corrected.

3.05 TRAINING

A. Provide training for the owner's maintenance personal on procedures and related startup and shutdown, troubleshooting, servicing, and preventive maintenance.

B. Review data in the operation and maintenance manuals with the Owner.

END OF SECTION

SECTION 26 3623

AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Automatic Transfer Switches

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0533, Raceways and Boxes for Electrical Systems

F. Section 26 0553, Identification for Electrical Systems

G. Section 26 0573, Overcurrent Protective Device Coordination Study

H. Section 26 0580, Electrical Testing

I. Section 26 3213, Engine Generators

1.03 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
   1. Underwriters Laboratories (UL).
      a. UL 508 Industrial Control Equipment
      b. UL 1008 Automatic Transfer Switches
   2. National Fire Protection Association (NFPA)
      a. NFPA 70 National Electrical Code (NEC)
      b. NFPA 110 Emergency and Standby Power Systems
   3. National Electrical Manufacturer's Association (NEMA)
      a. ICS Industrial Controls and Systems

1.04 SUBMITTALS

A. Shop Drawings

B. Product Data

C. Operating and Maintenance Data:
   1. Complete instructions covering the operation and testing of the automatic transfer switches.
   2. Maintenance instructions include the following:
      a. Complete Trouble Shooting
      b. Diagnostic Information
      c. Disassembly Instructions
      d. Assembly Instructions
      e. Preventive Maintenance Schedule
   3. Include data in Operating and Maintenance Manuals specified in Section 26 05 00, Common Work Results for Electrical.

1.05 WARRANTY

A. Warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

B. Comprehensive, including parts, labor, and travel to the site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Automatic transfer switches of the same manufacturer as the engine generator equipment specified in Section 26 3213, Engine Generators.

B. Asco

C. GE Zenith Controls

D. Russelectric

E. Or approved.

2.02 AUTOMATIC TRANSFER SWITCHING SYSTEM

A. Furnish each switch with full load current rating, voltage, phase, poles, and AIC ratings as shown on the drawings. Transfer switches capable of switching classes of load and rated for continuous duty when installed in non-ventilated enclosures.

B. Transfer Switches:
   1. 4-pole type provided with a switched neutral pole.
   2. Neutral pole of the same construction and have the same ratings as the phase poles.
   3. Switch poles simultaneously using a common crossbar.

C. Provide relays and control circuits to obtain fixed preferential control with transfer switch connected to the normal source of power under normal conditions.

D. Upon a sustained drop in voltage of 30 percent in any phase of the normal power source from rated voltage and after a delay of 2 seconds, switch closes circuit to automatically start the alternate power source and transfer the load to the alternate power source provided the voltage and frequency of that source are at least 90 percent of rated value.

E. Electrically operated switch but mechanically held in both the normal and standby positions and include an electrically continuous neutral position. Operator momentarily energizes from the source to which the load is being transferred. Upon return of normal power to within 10 percent of rated voltage on all phases, and after a preset time delay adjustable from 2 to 25 minutes, the switch automatically transfers the load to the normal source. If the standby power source should fail during the delay period prior to return to normal source, the time delay bypassed and the switch returns immediately to the normal source. Provide test switch to simulate failure of the normal power source and to test the operation of a transfer switch.

F. Provide a manual operator for maintenance servicing of the transfer switch in accordance with UL-1008.

G. Provide an override switch to bypass the automatic transfer controls so that the transferred switch will remain indefinitely connected to the standby power source, regardless of the condition of the normal power source.

H. Each automatic transfer switch furnished with voltage sensing relays for each phase. Connection of these sensing relays made to the normal power input terminals of the transfer switch. Voltage range field adjustable.

I. Delayed Transition:
   1. Controls include a time delay, adjustable from 0-60 seconds, to control the switching time from source to source, to allow load generated voltages to decay before connecting to an energized source.

J. High Intensity LED Lamps:
   1. Provide to indicate Source 1 and Source 2 Available, Source 1, and Source 2 Connected, exercise mode, and test mode.
   2. Source available LED indicators operates from the control microprocessor to indicate the true condition of the sources as sensed by the control.
   3. Transmit signals transmitted to the remote annunciator.
   4. Provide one set Form C auxiliary contacts indicating transfer switch position, rated 10A 250 VAC.

K. Install automatic transfer switch in a NEMA Type I wall mounted enclosure conforming to NEMA ICS and comply with the requirements of UL-508.

L. Provide a field-configurable exerciser clock, displaying real time in hours and minutes, with provisions for selection of testing interval at 7, 14, 21, or 28-day intervals in either with-load or without-load configuration. Exercise period duration field configurable.

M. If an elevator is being served by the transfer switch, the transfer switch provides a relay contact signal prior to transfer or retransfer. The time period before and after transfer adjustable in a range of 0 to 50 seconds.

N. Transfer Switch: Provide with AL/CU mechanical lugs sized for the full output rating of the switch, and capable of accepting the number of cables indicated on the drawings.

O. Automatic Transfer Switch:
   1. Suitable for satisfactory performance when installed for operation at 200-feet altitude, 104 degrees F high and 41 degrees F low ambient temperature, 90 percent relative humidity.

P. Thoroughly clean surfaces to be painted to ensure that they are free from all oil, grease, welding slag and spatter, mill scale, products of corrosion, dirt or other foreign products. Paint at least one coat of rust inhibiting primer and one coat of finish enamel.

Q. Apply rust inhibiting primer to a clean, dry surface as soon as practicable after cleaning. Painting with manufacturer's current materials according to manufacturer's current process except that the total dry film thickness not less than 2.5 mils.

R. Paint free from runs, sags, orange peel, or other defects.

S. Finish Coat Color of Paint: Manufacturer's standard.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mount transfer switches square and plumb, with top of switches 6 feet – 0 inches above finish floor.

B. Provide and install complete conduit, wiring, and electrical connections required between the various items of the System.

C. Engage a factory-authorized service representative to inspect the equipment, verify installation meets the manufacturer's requirements, and perform manufacturer recommended start-up testing.

D. Engage a factory-authorized representative to provide training of the Owner's personnel to adjust, operate, and maintain the automatic transfer switch equipment.

3.02 TRAINING

A. Provide training for the owner's maintenance personal on procedures and related startup and shutdown, troubleshooting, servicing, and preventive maintenance.

B. Review data in the operation and maintenance manuals with the Owner.

END OF SECTION

SECTION 26 4313

SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. The Sections includes:
   1. Surge Protective Devices
   2. Enclosure

B. Surge Protective Devices (SPD) for low voltage power equipment and provide effective high energy protection against transient surges, temporary over-voltages, voltage swells and high frequency noise attenuation.

C. This Section describes the materials and installation requirements for Surge Protective Devices (SPD). SPD's are used for the protection of AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

D. This specification also describes the mechanical and the electrical requirements for the SPD. Suitable for application in both category B and C environments as described in ANSI/IEEE C62.41- 2002.

E. Furnish and install the Surge Protective Devices having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract documents. Provide related hardware (i.e. flush mounting kits, mounting brackets, etc.) as required for the installation of the SPD system suitable for the application.

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 2313, Switchboards

D. Section 26 2416, Panelboards

1.03 REFERENCE STANDARDS

A. UL Underwriters Laboratories
   1. ANSI/UL 1449 Standard for Safety for Surge Protective Devices.

B. ANSI American National Standards Institute
   1. ANSI C84.1 American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hz).

C. IEEE Institute of Electrical and Electronics Engineers
   1. IEEE C62.41.1 Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits.
   2. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
   3. IEEE C62.45 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
   4. IEEE 142 IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (Green Book).
   5. IEEE 1100 IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (Emerald Book).

D. ISO International Organization for Standardization
   1. ISO 9001 Quality Systems – Quality Management System

E. MIL Standard 220 (Department of Defense) - Test Method Standard, Method of Insertion-loss Measurement.

F. NFPA 70 (National Fire Protection Association) - National Electrical Code.

G. UL 1283 (Underwriters Laboratories) - Standard for Safety for Electromagnetic Interference Filters.

1.04 SUBMITTALS

A. Include written specification response referencing each specification section and sub-section indicating compliance or non-compliance. If manufacturer cannot fully comply with specification section, this must be stated in the response along with a full description of the variance.

B. Submit the following information, indexed by response and test results. Receive a minimum of 2 weeks in advance of the date the submittal evaluation needs to be completed for the project.
   1. Specification compliance response sheet referencing each specification section.
   2. Proof of compliance to the current edition of UL1449 from a Nationally Recognized Test Lab (NRTL) accepted by local authority having jurisdiction. UL1449 Nominal Discharge Current Rating and Voltage Protection Ratings provided.
   3. UL1283 filter compliance documentation.
   4. Published specifications, cut sheets and product data with appropriate IEEE C62.41 and UL1449 (current edition) performance ratings for intended installation locations.
   5. Electrical and Mechanical Shop Drawings
   6. Installation Requirements/Instructions
   7. Operations and Maintenance Manuals
   8. Performance/Warranty Information

C. The Engineer reserves the right to accept or reject any or all submittals, to request additional information as deemed necessary or to request submittals for a different unit deemed more appropriate for this installation.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manuals

B. Warranty Documentation

C. Notes to Record Drawings

1.06 QUALIFICATIONS

A. UL1449 (current edition) compliance and listing from Nationally Recognized Test Lab (NRTL) accepted by local authority having jurisdiction. Type 1 compliance required for SPD intended for installation before (or after) Main Service Disconnect or Type 2 compliance for installation after Main Service Disconnect. Provide published UL1449 (current edition) Nominal Discharge Current Rating and Voltage Protection Rating.

B. Local representation and distribution within 400 miles of the project location to provide technical, warranty claim, and installation support for the project.

C. Manufacturer/vendor must be capable of supplying SPD for project within 30 days of receipt of order for orders of 25 units and less for models submitted in response to this specification.

D. Certified to latest ISO 9001 standard and registered for the design and manufacturing of SPD devices.

E. Provide access to a readily available factory engineer for answering questions about this product.

F. Only firms regularly engaged in the manufacture of SPD products for category C locations (ANSI/IEEE C62.41.1-2002), and whose products have been providing satisfactory service for not less than five years, considered. Upon request, provide a customer reference list, with a minimum of five contact names and current phone numbers.

G. Provide manufacturer qualifications as part of the submittal.

H. The successful manufacturer/vendor to assign a technical contact person for SPD application, installation, and warranty questions. Contact available to provide a response to a technical question within a maximum of two business days.

I. Single manufacturer capable of providing power system SPD’s.

1.07 DELIVERY, STORAGE AND HANDLING

A. Inspect for damage and replace any damaged device.

B. Store in a clean, dry space suitable for equipment and protect against damage.

C. Clean equipment and touch up minor scratches using suitable materials.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Provide equipment operation and maintenance manuals with each assembly shipped and include instruction leaflets and bulletins for the complete assembly and each major component.

1.09 WARRANTY

A. Minimum requirements:
   1. Period: 20 years from the date of substantial completion of service and activation of the system to which the SPD is attached.
   2. Full replacement of a suppressor which is damaged or fails to meet manufacturers published specifications and specifications provided within, without pro-rating value.
   3. No exclusions from failure or damage from any system anomaly (over-voltage, single phasing, lightning strike, etc. (IEEE 62.41.1).
      a. Exceptions: Failure caused by wiring error, loose, or missing Neutral to Ground Bond or Meggar Testing with SPD connected to power system.
   4. Factory or third party testing not required.
   5. Warranty applies independent of facility ownership / purchaser.
   6. Replacement unit to be at facility within 7 business days of receipt of written notification of failure at no cost to the customer (exception – custom configuration or special order units).
   7. Replacements: same make, model and configuration as original unit unless otherwise requested or approved.
   8. Manufacturer site visit for validation of warranty claim: manufacturer/vendor must visit site within 3 days of notification at no cost. This section does not modify 1.12 (A) (6).
   9. No shipping, handling, examination or other fees are allowed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Current Technology Inc. SPE Series, Leviton, Square D or of the same manufacture as the distribution equipment specified in Section 26 2413, Switchboards.

B. The listing of specific manufacturers above does not imply acceptance of their products which do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer 10 days prior to the bid date. Provide complete submittals for review as described above.

2.02 GENERAL DESIGN AND PERFORMANCE REQUIREMENTS

A. Performance and Ratings:
   1. Minimum durability and performance requirements are described below in accordance with test procedures outlined in ANSI/IEEE C62.45 and UL1449 (current edition). Provide test documentation as part of the submittal package. Provide information in a format which is easily to analyze and review. Submit the following test data as manufacturer published literature:
      a. Provide Peak Surge Current (Single Pulse Rated, 8/20μS, by mode, Amperes) with submittals document for each SPD proposed. For electrical equipment located at Service Entrance or Category C locations, Surge current rating a minimum of 160kA per phase / 80kA per mode for IEEE C62.41.1-2002 - Category C Low Exposure locations and 300kA per phase / 150kA per mode for IEEE C62.41.1-2002-Category C High Exposure locations or critical locations.
      b. Provide surge current ratings for each applicable protection mode (L-L, L-N, L-G and N-G) with submittals.

c. Surge Current Rating: Minimum of 80kA per phase / 40kA per mode in low exposure locations or 120kA per phase / 60kA per mode for distribution switchboards or motor control centers in medium and high exposure / critical equipment locations and for IEEE C62.41.1-2002 - Category B and C Switchboard and Motor Control Center Locations.

d. Provide surge current ratings for each applicable protection mode (L-L, L-N, L-G and N-G) with submittals.

e. Surge Current Rating:
   1) Minimum of 80kA per phase / 40kA per mode for branch panel models in low, medium and high exposure areas and for IEEE C62.41.1-2002 - Category B and C Panel and Sub-Panel Locations.

f. Provide surge current ratings for each applicable protection mode (L-L, L-N, L-G and N-G) with submittals.

g. For each SPD proposed, provide published durability test data utilizing the ANSI/IEEE C62.41-1991, Category C3, 20kV/10kA, 1.2 x 50 µS - 8x20 µS combination waveform for SPD durability tests with (as a minimum), the ANSI/IEEE C62.41-1991, Category C1, 6kV/3kA, 1.2 x 50 µS - 8x20 µS combination waveform used for pre and posttest measurement of let through performance variation. Provide test data with submittals, including test setup information.

h. SPD devices withstand a minimum of 15,000 IEEE C3 20kV/10kA hits delivered at a rate not exceeding one pulse per minute without failure or degradation exceeding 5 percent using IEEE B3 6kV/3kA combination waveform for pre and post durability let through measurement evaluation. Lead length for testing and let through measurements, 6-inchs.

i. UL Third Edition Nominal Discharge Current Ratings a minimum of 20kA per mode for SPD's to be installed at the Service Entrance (or where direct lightning strike potential exists on outdoor feeder or branch circuit conductors serving electrical equipment) and a minimum of 10kA per mode for all other locations.

j. Provide EMI/RFI Attenuation as per Mil Std-220. Attenuation 40dB at 100 kHz.

Maximum SPD voltage let through values are provided in Table 1 and 2 below. Provide published performance test data for the test configurations and waveforms listed in Tables with submittals. Table 1 - Peak Voltage Let Through Voltage Table for > 160 kA Units (at/ near Service Entrance locations) *Peak Let Through Voltages (measured from zero reference) not to exceed the following:

Voltage / Configuration	Test / IEEE Wave	L-N	L-G	L-L	N-G	Phase Angle
120/208 Wye	C3 – 20 kV/10ka	1050	1225	1350	1150	90
120/208 Wye	B3/C1 – 6 kV/3kA	565	590	925	550	90
120/208 Wye	A1 – 2kV/67A	260	390	360	250	90
120/208 Wye	A1 – 2kV/67A	75	115	90	100	180
120/208 Wye	UL1449 SVR	400	400	800	400	-----
120/208 Wye	UL1449 VPR	600	700	900	600	-----

*Complete testing with a minimum of 6-inch of lead length outside of device enclosure and measured from zero voltage crossing.

Note: Category A1 Ringwave applicable for locations where active tracking units are to be installed, including 120/208 and 120/240 branch panels and protection for dedicated equipment loads (where noted).

Table 2 – Peak Limiting (Let Through) Voltage Table for > 80 kA Units (Branch/Sub Panel, MCC, etc.) *Peak Let Through Voltages (measured from zero reference) not to exceed:						
Voltage / Configuration	Test / IEEE Wave	L-N	L-G	L-L	N-G	Phase Angle
120/208 Wye	C3 – 20 kV/10ka	1050	1225	1350	1150	90
120/208 Wye	B3/C1 – 6 kV/3kA	560	585	920	540	90
120/208 Wye	A1 – 2kV/67A	260	400	370	250	90
120/208 Wye	A1 – 2kV/67A	75	100	75	75	180
120/208 Wye	UL1449 SVR	400	400	800	400	-----
120/208 Wye	UL1449 VPR	600	700	900	600	-----
*Complete testing with a minimum of 6” of lead length outside of device enclosure and measured from zero voltage crossing.						
Note: Category A1 Ringwave applicable for locations where Active Tracking units are to be installed, including 120/208 and 120/240 Branch Panels and protection for dedicated equipment loads (where noted). Please note the phase angle is 90 degrees and measurement is positive peak voltage measured from zero reference. Measurements at 180 degrees will show significantly lower let through voltages (sine wave peak voltage is zero at 180 degrees).						

2.03 SURGE PROTECTIVE DEVICES

A. Compatible with the electrical system voltage, current, system configuration and intended applications and NRTL listed for such application.

B. Parallel design only with individual protection components:
   1. Line to Ground and Line to Line for Delta and High Resistance Grounded systems.
   2. Line to Ground, Line to Neutral and Neutral to Ground for Wye and Single Phase distribution systems.

C. Utilize Metal-Oxide Varistors (MOV) components as primary energy mitigation. Selenium cell, air gaps, gas tubes are not allowed.

D. Maximum continuous operating voltage (MCOV) of components (based on ANSI C84.1 standard voltages), not less than 125 percent for 120/208 volt systems and 115 percent for other systems.

E. Short Circuit Current Ratings (SCCR): Suitable for location SPD is to be installed.

F. Visual indication of protection status on each phase, visible from the front of the equipment.

G. Protection Status:
   1. Normally open and normally closed contacts for remote monitoring.
   2. Rated a minimum of .5A, AC or DC.
   3. Change state upon device failure or loss of power.

H. As a minimum, Branch Panel, Sub-Panel and series installed (branch circuit) SPD includes a passive circuit which allows the SPD to actively follow the voltage waveform and provide a clamping envelope to limit low level IEEE C62.41 Category A ring waves (of either polarity) at all locations on the sine wave. Circuit to perform in the Neutral to Ground Mode.

I. Provide complete, comprehensive installation instructions.

2.04 ENCLOSURE

A. NEMA rated metal enclosure appropriate for environmental conditions and exposure at point of installation.

B. Designed to allow connection of the SPD without sharp bends in the conductors.

C. Metal flush kits for flush mount installations (external devices) on new and retrofit applications for panels. Include supports for fastening to structural members and include a faceplate matching SPD finish. Retrofit kits capable of being installed next to the panel after drywall has been installed without the need for patching or refinishing of the wall.

PART 3 EXECUTION

3.01 GENERAL

A. General Application and Installation Requirements
   1. Per the manufacturer's installation instructions.
   2. Per Installation Checklist.
   3. NFPA 70 (NEC) Requirements.
   4. Per IEEE C62.41.2, 141, 142 and 1100.
   5. Local Authority Having Jurisdiction
   6. Project Engineer

B. Tap directly to the bus without upstream over-current protection unless tap conductors are protected at their termination by NRTL listed Disconnect, Over-current and Short Circuit Protective Devices (Fuse with Disconnect and/or Circuit Breaker) properly rated for conductor and SPD Device Protection as per NRTL listing and NEC requirements.

C. Provide qualified personnel to provide one hour of on-site installation training for contractor.

D. Clean SPD units and flush mount covers and touch up with matching paint as necessary.

E. Inspect and test SPD devices as per manufacturer specification and installation guidelines.

F. Project Engineer or their appointed representative may perform inspection of the installed suppressors. Engineer reserves the right to require corrections to the installation to comply with manufacturer installation requirements and project specifications.

3.02 TESTING

A. Complete installation checks according to the manufacturers written instructions.

B. Remove and replace malfunctioning units and retest.

3.03 SERVICE ENTRANCE

A. Service Entrance Installation Requirements
   1. One primary suppressor at each utility service entrance to the facility or as indicated on the drawings.
   2. Connect suppressors to properly rated disconnect with overcurrent and short circuit protective device connected on the load side of the service entrance disconnecting means in accordance with NEC requirements.
   3. Conductors between suppressor and point of attachment kept as short and straight as possible and group together (via tie wrap) where possible. Lead length of connecting conductor not to exceed 2-feet without written permission of the Engineer.
   4. Bond suppressor's ground to enclosure frame and the service entrance ground bus, and conduit between the SPD and the switchboard must provide secure electrical/mechanical connections.

END OF SECTION

SECTION 26 5000

LIGHTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Lenses
   2. Reflector Cones
   3. Housings
   4. Finish
   5. Suspension
   6. Lamps and Sockets
   7. Power Supplies
   8. Emergency LED Drivers
   9. Transformers
   10. Track Lighting Systems
   11. Custom Luminaires
   12. Exterior Luminaires
   13. Extra Material
   14. Disposal and Replacement

1.02 RELATED SECTIONS

A. Division 01, General Requirements

B. Division 26, Electrical

C. Section 26 0519, Low Voltage Electrical Power Conductors and Cables

D. Section 26 0526, Grounding and Bonding for Electrical Systems

E. Section 26 0923, Lighting Control Devices

F. Section 26 0933, Central Dimming Controls

G. Section 26 0943, Network Lighting Controls

H. Section 26 0993, Sequence of Operations for Lighting Control

I. Section 26 2726, Wiring Devices

1.03 DEFINITIONS

A.	BACNET	Protocol for integration with BAS/BMS/EMS
B.	BAS	Building Automation System
C.	BMS	Building Management System
D.	EMS	Energy Management System
E.	CCT	Correlated Color Temperature
F.	CRI	Color Rendering Index
G.	CS	Control Station
H.	D	Dimming Wall Switch
I.	DT	Dual Technology (PIR + U)
J.	FC	Footcandles

   1. The metric for measuring illuminance light levels

K.	GUI	Graphic User Interface
L.	LCP	Lighting Control Panel
M.	LED	Light Emitting Diode
N.	LonWorks	Protocol for integration with BAS/BMS/EMS

O. MTBF Minimum Time Between Failures
   1. Total hours of testing / Number of failures

P. OS/VS Occupancy Sensor / Vacancy Sensor,
   1. Occupancy sensors provide automatic on and automatic shut-off.
   2. Vacancy sensors provide automatic shut-off only, and require manual-on.

Q. PC Photocell

R. PIR Passive Infrared Technology

S. Power Supply Ballasts and LED drivers

T. RS RS-232 Connection for AV Integration

U. SC Scene Control

V. TC Timeclock, or astronomical timeclock

W. U Ultrasonic Technology

X. WS Wall Switch

Y. WS/O Wallbox Occupancy Sensor Switch
   1. Wall Switch with integrated Occupancy Sensor

1.04 QUALITY ASSURANCE

A. The lighting design for this project was based on luminaire types and manufacturers as specified.

B. Basis of Design manufacturers are pre-qualified to bid on products where specified. Inclusion of manufacturer and product series does not relieve specified manufacturer from providing product as described in luminaire schedule; modifications to standard product, if required, include with initial bid.

C. Alternate manufacturers listed in the Luminaire Schedule do not require prior approval but included with the shop drawing submittal. Inclusion of manufacturer and product series as an alternate does not relieve the manufacturer from providing product equivalent to the basis of design as described in luminaire schedule; modifications to standard product, if required, include with initial bid.

D. Or Approved or Pre-Bid Approved Equal:
   1. Submit Substitution Request prior to bid, complying with requirements of Division 01, General Requirements.
   2. Approval determined by review of the following luminaire characteristics where applicable. Lack of pertinent data on characteristic constitutes justification for rejection of the submittal.
      a. Performance:
         1) Distribution
         2) Utilization
         3) Average brightness/maximum brightness.
         4) Spacing to mounting height ratio.
         5) Visual comfort probability.
      b. Construction:
         1) Engineering
         2) Workmanship
         3) Rigidity
         4) Permanence of materials and finishes.
      c. Installation Ease:
         1) Captive parts and captive hardware.
         2) Provision for leveling.
         3) Through-wiring ease.
      d. Maintenance:
         1) Relamping ease.

2) Ease of replacement of ballast and lamp sockets.

e. Appearance:
   1) Architectural integration.
   2) Light tightness.
   3) Neat, trim styling.
   4) Conformance with design intent.

1.05 GENERAL REQUIREMENTS

A. Provide lighting outlets indicated on the Drawings with a luminaire of the type designated and appropriate for the location.

B. Where a luminaire type designation has been omitted and cannot be determined by the Contractor, request a clarification from the Architect in writing and provide a suitable luminaire type as directed.

C. Coordinate installation of luminaires with the ceiling installation and other trades to provide a total system that is neat and orderly in appearance.

D. Luminaires located in fire rated assemblies rated for use in such assemblies or have assembly maintained by the installer through the use of appropriate construction techniques to maintain the assembly rating. It is the responsibility of the contractor to maintain the assembly rating and provide required components during construction. Coordinate luminaires impacted with Division 01, General Requirements, and life safety documents.

E. Install remote power supplies and transformers in enclosures as required by luminaire specified. Locate remote power supplies and transformers as shown on drawings; where no location is shown, provide recommendation for approval prior to commencing field installation. Locate remote mounted power supplies and transformers within the distance limitations specified by the manufacturer.

F. Exterior pole lights have an appropriated pole base as part of the assembly. For pole lights in pedestrian areas, use a flush pole base. Pole lights in parking areas a raised base used. Pole bases, footings, and structural components reviewed and approved by a state licensed structural engineer prior to ordering and installation.

G. Linear lighting elements installed on building exterior, in coves, soffits, panels and other architectural materials are the longest sections available to meet the intent of the design and centered in the available space. Other items required to make the lights function installed out of site and coordinated with Architect, Landscape Architect, Lighting Designer and Electrical Engineer of Record. Transformers, drivers, and ballasts in suitable enclosures. Required connection points are the minimum box or connector available from the manufacturer. Standard electrical boxes are not allowed to produce linear runs in architectural coves. Ancillary material required is concealed from view. Coordinate final ceiling material, dimensions, and limitations with the ceiling manufacturer prior to ordering and installation.

H. Coordinate voltage requirements to each luminaire as indicated on drawings.

I. Verify luminaires carry a valid UL or ETL listing. Luminaires located in outdoor locations to carry and appropriate wet or damp listing as required for the mounting application.

J. Procure luminaires through a distributor located within 200 miles of the project site with a valid business license in the state the project is located.

K. Upon request of the Architect, Engineer, or Owner, provide back-up pricing in a unit cost breakdown per luminaire. Back-up pricing includes distributor net pricing, contractor net pricing, final owner pricing and mark-ups and discounts (lot price or all-or-none) associated with the luminaires.

L. Lighting related change orders to include back-up pricing noted above for review by the Engineer and Lighting Designer.

M. Provide manufacturer's warranty covering 5 years on drivers from date of purchase. Luminaire manufacture to operate driver at or below the required driver warranty temperature. Luminaire manufacturers failing to operate the driver, at the project required ambient temperature and within the driver manufacturer warranty parameters, will be responsible for driver warranty related costs over the warranty period.

N. 80 percent of the luminaire material by weight at a minimum should be recyclable at end of life. Design luminaire for ease of component replacement and end-of-life disassembly.

1.06 SUBMITTALS

A. Submit the following in accordance with Section 26 0500, Common Work Results for Electrical:
   1. Shop Drawings, to include:
      a. Product Data:
         1) Provide manufacturer's published product data information.
         2) This information is to be relevant to the specified product only.
         3) Submittals limited to not more than three sheets for each type specified.
         4) They are specifically not to have configurations available included for review.
         5) Submittals that contain information that is not relevant to the product specified will be rejected in total and resubmission will be required.
      b. Luminaire dimensions on a fully dimensioned line drawing.
      c. Lamp information, including array configuration:
         1) For LED lamps: proof of conformance with the following: ANSI C78.377-2015, IES LM 79-2008, IES LM 80-2008, IES LM 82-2012, IES LM 84-14, IES LM 85-14, IES TM 21-2011, IES TM 28-14 and special certifications required by the contract documents.
      d. Lamp socket information.
      e. Power supply and transformer information using ballast manufacturers published product data information. Multiple power supplies or transformers may be submitted for single luminaire if compatible with specification included in contract documents. Include certification of lamp and power supply and transformer compatibility for submitted.
      f. Mounting details including clips, canopies, supports, and methods for attachment to structure. Provide equipment required for row configurations.
      g. UL/ETL Labeling Information
      h. Manufacturer's Warranty
      i. Photometric Reports consisting of the following:
         1) Candlepower distribution curves: Provide five plane candlepower distribution data at no more than 5 degree vertical angle increments.
         2) Coefficient of utilization table.
         3) Zonal lumen summary including overall luminaire efficiency.
         4) Luminaire luminance: Provide measured maximum brightness data for luminaires with reflectors and average brightness data for luminaires with refractors.
         5) Spacing to mounting height ratio. If parallel and perpendicular ratios differ, provide data on each plane.
         6) Pole information to include maximum supported effective projected area (EPA) and weight for the design wind speed, as well as structural calculations for each pole proposed.
         7) VCP calculations (where applicable): For general office lighting luminaires, provide typical VCP calculations for ceiling heights between 9-feet and 12-feet at 1-foot increments, for room sizes 20-feet by 20-feet and 30-feet by 30-feet.
      j. Special requirements of the specification.

2. Operation and Maintenance Data:
    a. Prepare two copies of a Lighting Systems Maintenance Manual consisting of the following in a hard-cover binder for review. After review, Architect will deliver one copy to Owner. Manual to include:
        1) One complete set of final submittals of actual product installed, including product data and shop drawings. Include product data for actual power supply and transformer installed where applicable.
        2) List of lamps used in Project, cross-referenced to fixture types, with specific manufacturer's names and ordering codes.
        3) Re-lamping instructions for lamps that require special precautions (LED, tungsten halogen, metal halide, etc.).
        4) Lighting fixture cleaning instruction, including chemicals to be used or avoided.
        5) Parts list of major luminaire components and ordering information for replacement
        6) Copies of manufacturer warranties on product.
3. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.
4. Manufacturer's Installation Instructions:
    a. Indicate application conditions and limitations of use stipulated by product testing agency.
    b. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
5. Closeout Submittals:
    a. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.
    b. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
    c. Maintenance Materials: Furnish for Owner's use in maintenance of project.

PART 2 PRODUCTS

2.01 GENERAL

A. Luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.

B. Luminaire assemblies UL listed.

C. Luminaires UL listed appropriate to mounting conditions and application.

D. Install recessed luminaires in fire rated ceilings and use a fire rated protective cover thermally protected for this application and carry a fire rated listing.

E. Luminaires installed under canopies, roofs, or open areas and similar damp or wet locations to be UL listed and labeled as suitable for damp or wet locations.

2.02 LENSES

A. Mechanically secured from within the housing.

B. Interior linear prisms with smooth exterior.

C. Prismatic Acrylic:
    1. As specified in the Luminaire Schedule.

D. Opal Acrylic:
    1. Extruded or injection molded of virgin acrylic plastic, 0.08-inch minimum overall thickness.
    2. As specified in the Luminaire Schedule.

E. Opal Acrylic Overlay: High transmittance type, extruded of virgin acrylic plastic, 0.04-inch overall thickness, with minimum 80 percent light transmittance.

2.03 REFLECTOR CONES

A. Spun of uniform gauge aluminum, free of spinning marks or other defects.

B. Integral trim flange.

C. Color and finish as specified in Luminaire Schedule.

D. White Reflectors: Steel or aluminum, minimum 22 gauge, with hard baked white enamel finish with minimum 85 percent reflectance.

E. Alzak Reflectors:
   1. Low iridescent semi-specular or as indicated in the luminaire schedule, Alzak or Coilzak with minimum reflectance of 90 percent.
   2. Supply luminaires using Alzak reflector cones by the same manufacturer unless directed otherwise in Luminaire Schedule.

2.04 HOUSINGS

A. Dimensions: Proper for the various wattage noted on the plans and as recommended by the luminaire manufacturer or as specified in the luminaire schedule.

B. Extruded Aluminum Housing:
   1. One piece housing of AA 6063 T5 extruded aluminum with 0.14 minimum thickness smooth and free of tooling lines in one uninterrupted section of 1-foot to 24-foot with the cross sectional dimensions as indicated in the Luminaire Schedule.
   2. Section lengths as shown on the drawings and able to be transported into and out of the installation location after final construction without building demolition being required.

C. Steel Housing:
   1. 20 gauge minimum, free of dents, scratches, or other defects.
   2. Fill and sand exposed weld marks, joints, and seams smooth before finishing. Clean and dress edges to remove sharp edges or burrs.
   3. Section lengths as shown on the drawings comprised of 1-foot to 12-foot lengths.

D. Sheet Metal Housings: Minimum 22 gauge cold-rolled steel, with welded joints. Exposed weld marks and seams filled and ground smooth.

E. Door Frames for lensed luminaires: White painted, flat aluminum with mitered corners, spring assisted latches to hinge from either side.

F. End Plates: Mechanical attach die cast end plates without exposed fasteners. End caps, minimum 0.125-inch thick.

G. Provide an internal alignment spline where housing sections are joined together to form a continuous row.

H. Recessed Luminaires:
   1. Rated for use in recessed applications.
   2. If required by the owner or design team, provide test data proving the product is rated for use in recessed applications.
   3. Equip with through wire junction box. Box, power supply, and replaceable components accessible from the ceiling opening of the luminaire.

I. Luminaires used as air-handling registers for HVAC systems meet the requirements of NFPA 90A.

J. For wet and damp use, LED-based luminaire to be sealed, rated, and tested for appropriate environmental conditions and may not be accomplished by using an additional housing or enclosure

2.05 FINISH

A. Visible surfaces to be of color and texture as directed in Luminaire Schedule.
   1. Baked white dry polyester powder, if not specified, with a minimum average reflectance of 85 percent on exposed and light reflecting surfaces.

B. Concealed interior and exterior luminaire surfaces to be Matte black or as recommended by the luminaire manufacturer.

C. Prepare steel components for finishing with a 5-step zinc phosphating process prior to painting.

D. Exposed steel surfaces:
   1. Treat with acid wash and clear water rinse, then prime coat.
   2. Electrostatically paint or powder coat and oven bake in the color indicated in the Luminaire Schedule.

2.06 SUSPENSION

A. Suspension Devices, type as specified in the Luminaire Schedule:
   1. Aircraft Cable:
      a. Stainless steel type: 3/32-inch nominal diameter, stranded, with positive pressure, field adjustable clamp at fixture connection.
   2. Rigid Pendant:
      a. 1/2-inch nominal diameter or as specifically shown on drawings.
      b. Supplied by fixture manufacturer when available as standard product.
      c. At fixture end of stems, provide earthquake type swivel fitting to permit 45 degree swing in any direction away from vertical.
      d. Flat canopy to permit splice inspection after installation.
   3. Chain Hangers:
      a. Length to suit fixture mounting height if shown or as field conditions dictate.
      b. Use two heavy duty chains with S hooks at each suspension point.
      c. Length to suit mounting height as shown on Drawings.
   4. Suspension system must permit ±1/2-inch minimum vertical adjustment after installation.

B. Supports:
   1. Provide internal safety cable from fixture body to structure.
   2. Carry fixture weight to structure and provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting. Provide diagonal seismic restraint wires per code.

C. Feed Point:
   1. Flat-plate canopy to cover outlet box, with holes for support cable and power cord, concealed fasteners to permit splice inspection after installation.
   2. At the electrified connection provide straight cord feed. Provide a separate feed point where emergency feed is required.
   3. Power Cord: White multi-conductor cord, parallel to support cable (aircraft cable); within pendant (rigid pendant); or flexible conduit (chain hanger).
   4. Provide a separate fee point where emergency feed is required.

D. Non-feed Points:
   1. 1/2-inch OD polished chrome end sleeve, inside threaded 1/4-inch-20, with 2-inch diameter. Flat white plate to cover hole in ceiling. Top of cable with ball swaged on end, to fit inside sleeve.
   2. Provide support above ceiling as required.

E. Suspension method allows adjustment to be made in hanging length to allow for variance in ceiling height.

F. Exposed paintable suspension components have the same finish and color as the luminaire housing.

2.07 LAMPS AND SOCKETS

A. Lamp each luminaire with the suitable lamp cataloged for the specific luminaire type and as indicated by the manufacturer, or as specifically indicated in the Luminaire Schedule, or as specified herein.

B. Lamps to be field replaceable.

C. Lamp sockets to be of configuration and design to accept standard LED lamps and circuit boards.

D. LED lamps to meet or exceed 50,000 hours as defined by LM-80-08 based on both the ambient temperature listed and the LEDs B10L70 performance curve as published by the LED lamp manufacturer.

E. LED lamps to be high brightness and proven quality from established and reputable LED manufacturers, including:
   1. Nichia
   2. Osram-SemiOpto
   3. Cree
   4. Philips Lumileds
   5. Seoul Semiconductor
   6. Bridgelux
   7. General Electric Gelcore
   8. Xicato
   9. Osram

F. Replacement Lamps:
   1. Sorra
   2. Toshiba

G. LED lamps that are integral into the housing; light bars, diodes, boards and other, to be rated and tested for use in the fixture specified and compatible with the driver tested and compatible with that fixture.

H. Screw-In Base Replacement LED Lamps:
   1. Manufacturer to provide wattage restriction label on socket, equivalent to specified wattage on LED replacement lamp.
   2. LED replacement lamps not to be placed in air-tight enclosures or in insulated air tight (ICAT) rated luminaire enclosures without dedicated heat dissipation and thermal management of the luminaire system.

I. Color Rendering Index (CRI):
   1. 90+ per ANSI C78.377-2008/CIE 13.3-1995 unless noted otherwise on the luminaire schedule.

J. Correlated Color Temperature (CCT) per luminaire schedule: Color consistency not to exceed a +/- tolerance of greater than two MacAdam Ellipses over the life of the luminaire.

K. Adjustable Lamp Mechanisms: Include aiming stops which can be permanently set to position lamp vertically and rotationally.

L. High power LED luminaire thermally protected using one or more of the following thermal management techniques: metal core board, gap pad, and/or internal monitoring firmware

M. Operating Temperature:
   1. -22 degrees F to 115 degrees F.
   2. Operate below manufacturer's published die junction temperatures when operated at 1W at 350 mA in an elevated ambient of 46 degrees C.

N. Utilize quick-connect connections to replaceable boards to meet ANSI and UL/ETL and NEMA requirements.

2.08 POWER SUPPLIES

A. UL recognized under the component program and modular for simple field replacement.

B. Rate for use with the LED array specified:
   1. Warranty array and driver as an assembly.
   2. 5 year full replacement, non-pro-rated warranty is required on electronic components.

C. Luminaires requiring more than one driver are not permitted, unless specified in the luminaire schedule.

D. Power supplies used in enclosed and gasketed luminaires listed for use in wet locations, Type 1 construction.

E. Rate for the expected ambient temperature in which they are installed.
   1. Exterior installed power supplies rated to start the lamps at 0 degrees F.

F. Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.

G. Power Factor: 0.9 minimum

H. Lifetime minimum:
   1. 50,000 hours at full load and 77 degrees F ambient
   2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

I. Minimum time between failures (MTBF) greater than 300,000 hours at full load and 77 degrees F ambient, in accordance with MIL-HDBK-217.

J. Driver and luminaire electronics deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10).
   1. Flicker index to be less than 5 percent at frequencies below 1000 Hz.

K. Label systems using tandem wired luminaires be labeled accordingly. Locate label in the lamp compartment of each luminaire and identify the function of that luminaire. Do not make the label visible from room.

L. Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. Imbalance current is not allowed to exceed full output THD at any point in the dimming curve.

M. Meet or exceed 30mA^{2}s at 277VAC for up to 50Ws of load and 75A at 240us at 277VAC for 100 watts of load.

N. Withstand up to a 1,000V surge without impairment of performance as defined by ANSI C62.41 Category A.

O. Housing have circuit diagrams and lamp connections applied thereto.

P. Reduction of Hazardous Substances (RoHS) compliant.

Q. Provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control deadband between 0.5V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

R. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
   1. Adjustment of forward LED voltage, supporting 3V through 55V.
   2. Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA
   3. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

S. Remote: Driver may be remote mounted up to 300-feet depending on power level and wire gauge.

T. Dimming Drivers:
   1. Dimming power supplies controlled by a common controller by the same manufacturer.
   2. Manufacturer to have minimum 5 years of experience in manufacturing dimmable electronic lighting drivers.

3. LED dimming to be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment.
    a. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
4. Provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 – 1 percent light output and step to 0 percent where indicated. Driver responds similarly when raising from 0 percent to 100 percent.
    a. Driver to be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
5. Track evenly across multiple fixtures at light levels, and provide input signal to output light level that allow smooth adjustment over the entire dimming range.
6. Limit inrush current.
7. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
8. Configure a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels
9. Basis of Design Product: eldoLED or subject to compliance and prior approval with specified requirements of this section, one of the following:
    a. eldoLED
    b. Philips
    c. Osram Sylvania
    d. Tridonic
    e. General Electric
10. Dimming Protocols:
    a. If not otherwise noted on the luminaire schedule, dimming LED drivers to be 0-10V.
    b. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:
        1) Meet IEC 60929 Annex E for General White Lighting LED drivers.
        2) Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
        3) Must meet ESTA E1.3 for RGBW LED drivers
        4) 0-10V input protected from line voltage miswire, and immune and output unresponsive to induced AC voltage on the control leads.
    c. As indicated in the luminaire schedule.

2.09 TRACK LIGHTING SYSTEMS

A. Lighting Track:
    1. Extruded aluminum track with extruded poly-vinyl insulator.
    2. 20A, copper conductor strips with separate ground to provide electrical and mechanical connection for the specified track mounted luminaires.
    3. Include number of circuits as indicated in luminaire schedule, with separate neutrals per circuit.
    4. Provide connectors, elbows, stems, feed ends, end caps and fittings to make a complete system.

B. Track Fittings:
    1. Provide positive mechanical and electrical connection for track heads to track.
    2. Removable fittings either twist into or snap into specified lighting track.

C. Luminaire dimensions: Proper for the various wattage noted on the plans and as recommended by the luminaire manufacturer or as specified.

D. Adjustable Lamp Mechanisms: Adjustable aiming which can be set to position lamp vertically and rotationally.

E. Transformers:
   1. Provide proper lamp voltage to low voltage lamps.
   2. Magnetic transformers encapsulated for silent operation.
   3. Integrally mount Magnetic and electronic transformers to luminaire.

F. Finish: Visible surfaces to be of color and texture as directed in Luminaire Schedule.

G. Labels: Track and track fittings compatible and be UL labeled and listed as a system.

2.10 CUSTOM LUMINAIRES

A. Custom luminaire manufacturer no less than five years of continuous experience in the design and manufacture of custom lighting elements of the type and quality shown.

B. Specifications and drawings are intended to convey the features, function and character of the custom luminaire only and do not necessarily illustrate every component or detail required in the finished piece of equipment.

C. Include details and components that are necessary for the proper appearance and functioning of the custom luminaire.

D. Provide operational sample prototype luminaire for review and revision, if specified, of each custom luminaire type. Install and connect sample prototype luminaire by the contractor in a mutually acceptable location for demonstration and evaluation by the design team. Final judges on determining whether the prototype sample complies with specification is up to the Architect and Lighting Consultant.

2.11 EXTERIOR LUMINAIRES

A. Label fixtures from the factory for use in the designed installation. Verify labeling and installation requirements with the NEC and applicable codes and standards:
   1. External Label: ANSI C136.15
   2. Luminaires must have locality-appropriate governing mark and certification.

B. The luminaire must be subjected to 100,000 cycles of 2 Gs at the resonant frequency of the luminaire (between 5 and 30 Hz) applied at the center of gravity of the luminaire on three primary axes per ANSI C136.31 without damage to the luminaire. Luminaire must be fully functional upon test completion.

C. Luminaire must be IP and/or UL-listed for damp or wet locations, as appropriate for exterior application. Wiring cavity must be field accessible for service or repair needs.

D. Luminaires must be fully assembled and electrically tested before shipment from factory.

E. Optical cavity must be a minimum IEC 60529/IP65.

F. Rate luminaires for -4 degrees F to 104 degrees F operation.

G. The coating must be capable of surviving ASTM B117 Salt Fog environment for 500 hour minimum without blistering or peeling. The coating must demonstrate gloss retention of greater than or equal to 90 percent for 500 hour exposure QUV test per ASTM G53 UVB313, 4 hour UV-B 140 degrees F/4 hour condensation 122 degrees F.

H. Provide luminaires with a NEMA distribution pattern as indicated in the luminaire schedule.

I. Water feature and fountain lighting to meet applicable codes and regulations.

J. Project Conditions Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under Work of Other Sections, or by others.
   2. Coordinate elevation to obtain specified foundation height.
   3. Notify Owner of conflicts or deviations and obtain direction prior to proceeding with Work.

K. Exterior Lenses:
   1. In-grade lenses drive-over and cool touch rated.

2. For lenses not integral to the LED lamp, construct the luminaire optical enclosure (lens/window) of clear and UV-resistant polycarbonate, acrylic, or glass.

L. Unless otherwise indicated, provide cast-in-place embedded style concrete foundations with constructed forms for square foundations or round foundations with spirally wrapped treated paper forms. Provide concrete, anchor bolts, and reinforcing steel as indicated in the Drawings.

M. Poles:
1. Provide poles of material and form as indicated in the luminaire schedule or as required by local jurisdiction and/or local codes if they are more stringent.
2. Provide poles with a hand-hole and removable hand-hole coverplate that matches the material and finish of the pole. Install covers with vandal resistant bolts. Locate hand-hole located approximately 18-inches above the pole base.
3. Provide poles with provisions for installation of Owner provided and installed security cameras. Provide hand-hole with removable hand-hole coverplate that matches the material and finish of the pole. Locate hand-hole based on Owner design of security cameras.
4. Provide poles with an internal ground lug easily accessible from the hand-hole.
5. Provide poles with a base plate welded to the pole utilizing a backup ring and full-penetration welded connection.
6. Provide a one piece base cover to completely cover foundation hardware.
7. Aluminum Poles:
   a. Seamless extruded aluminum shafts fully welded to a cast aluminum anchor base assembly.
      1) Provide shaft square, straight, and meeting requirements of AASHTO Standard Specifications.
      2) Pole Height: As indicated in the Luminaire Schedule.
8. Pole Finish:
   a. Provide external surfaces of the pole, base cover, support arms, and luminaires finished in the same material and color.
   b. Provide poles chemically cleaned, rinsed, phosphatized, sealed, and dried.
   c. Apply an electrostatic application of polyester-power paint to external surfaces.
   d. Oven-bake complete unit to form a homogeneous, non-porous surface. Provide completed finish with no sags, drips, oxidation, or runs.
9. Anchor Bolts:
   a. Provided size, length and quantity as recommended by pole manufacturer.
   b. Fabricate anchor bolts from hot rolled carbon steel bar with an L bend on one end.
   c. Provide galvanized anchor bolts with a minimum of 12-inches on the threaded end.
   d. Provide bolt circle and bolt projection dimensions with manufacturer's Shop Drawings.
10. Wrap poles in a protective material for shipment to the Project site.

2.12 EXTRA MATERIAL

A. Furnish extra materials described below. Match product installed and packaged with protective covering for storage and identified with labels describing contents.
1. Glass and plastic lenses, covers, louvers, globes, guards, and other removable fixture parts: 5 percent or one dozen (whichever is less) of each type and rating installed. Furnish at least one of each type.
2. Control gear: 5 percent or one dozen (whichever is less) of each field-replaceable control module, driver, ballast, or individual fixture transformer. For fixtures with non-easily replaceable control gear provide 5 percent or one dozen (whichever is less) extra fixtures. Confirm non-replaceable products during submittal process.
3. Adjustable accent lights (track, recessed, or surface mounted): 10 percent of each beam angle lens (or removable lens accessory), 10 percent or one dozen (whichever is less) additional accessory lenses, color filters, louvers, and other accessories specified for use during final focusing.

4. For non-decorative LED lights: provide 2 percent additional fixtures, or minimum two fixtures.

2.13 DISPOSAL AND REPLACEMENT

A. LED manufacturer is responsible for the disposal of expired LED arrays and heat sinks. Clearly label fixture with return information, disposal procedures and manufacturer disposal contact information.

B. Owner will pay for shipping.

C. Manufacturer is required to inform the owner of new power requirements and /or lumen output values if new replacement components prior to shipping replacement parts.

D. Label disposal and replacement information inside the luminaire and in the project operation and maintenance manuals along with O&M requirements listed in Division 01, General Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Meet general requirements of NFPA 70, National Electric Code.

B. Mounting heights specified on drawings:
   1. Wall Mounted Luminaires: Centerline of luminaire.
   2. Pendant Mounted Luminaires: Bottom of luminaire unless specifically identified in the Luminaire Schedule or on drawings.

C. Support:
   1. Support by separate means from the building structure and not from the ceiling system, ductwork, piping, or other systems.
   2. Final decision as to adequacy of support and alignment will be given by the Architect.

D. Power Supplies:
   1. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
      a. Ambient temperature: -4 degrees to 122 degrees F.
      b. Relative humidity: Maximum 90 percent, non-condensing.
      c. Protected from dust and excess moisture during installation.
   2. Install per manufacturers prescribed methods.
   3. Located remote mounted power supplies and transformers within the distance limitations specified by the power supply manufacturer.

E. Level luminaires, align in straight lines, and locate as shown on the architectural elevations and reflected ceiling plan.

F. Manufacturer's labels or monograms not visible after luminaire is installed, but must be included for future reference.

G. Recessed Luminaires:
   1. Trims which fit neatly and tightly to the surfaces in which they are installed without light leaks or gaps.
   2. Install heat resistant non-rubber gaskets to prevent light leaks or moisture from entering between luminaires trim and the surface to which they are mounted.

H. Pole Luminaires:
   1. Provide cast-in-place concrete foundations for pole mounted luminaires.
   2. Concrete: As specified in Division 03, Concrete.
   3. Foundation Forms: As indicated.
   4. Place anchor bolts in foundation as recommended by manufacturer in the required bolt circle size.
   5. Tie reinforcing steel in foundation to the anchor bolts to form a solid cage.
   6. Tamp wet concrete during pouring to assure complete coverage below, around and within the cage and form.

7. Hand finish top of foundation to produce a smooth, level surface.
8. Provide a minimum 10-foot copper-clad steel ground rod at each pole base. Connect from ground rod to the ground lug in the pole with minimum AWG 8 copper conductor.
9. Install pole mounted luminaires plumb with luminaires level, and with reflector distribution in the direction indicated in the Drawings.
    a. Grout around the pole base at the foundation to close openings.
    b. Install pole base cover over exposed installation hardware.

I. Tungsten Halogen Lamps:
1. Use silk gloves to insert lamps into luminaires.
2. Do not energize luminaires during construction to prevent dust build up on lamp, socket and lamp chamber. Lamping occurs as last stage of construction.

3.02 COORDINATION OF WORK

A. Architectural Reflected Ceiling Plans take preference as to the exact placement of the luminaires in the ceiling.

B. Determine ceiling types in each area and provide suitable accessories and mounting frames where required for recessed luminaires. Luminaire catalog numbers do not necessarily denote specific mounting accessories for type of ceiling in which a luminaire may be installed.

3.03 AIMING

A. Aim luminaires with proper lamps installed.

B. Aim directional luminaires, including but not limited to luminaires described in the Contract Documents or by the luminaire manufacturer as aimable, adjustable, or asymmetric as follows:
1. Provide the lighting pattern for which the luminaire is designed.
2. Provide the lighting pattern as shown on the drawings.
3. Predetermined aiming points as shown on the drawings.
4. Where aiming cannot be determined, request, in writing, clarification from the Architect, indicating luminaires needing clarification.

C. Re-aim luminaires as determined by Architect during final project walkthrough.

D. Install adjustable luminaires with dead zone of rotation away from intended aiming point

3.04 PROJECT CLOSEOUT

A. Leave luminaires clean at the time of acceptance of the work. If luminaires are deemed dirty by the Architect at completion of the work, clean them at no additional cost. Protective plastic wrap is to be removed from parabolic luminaires just prior to owner acceptance.

B. Provide fixtures with new lamps operating at time of final acceptance. Exception: For fluorescent dimming fixtures, provide minimum 100 hour/maximum 200 hour, continuously lit lamps or per ballast manufacturer's recommendations.

C. Where incandescent lamps are used for construction lighting, replace the lamps with new lamps just prior to occupancy by the owner.

END OF SECTION

SECTION 27 0000

COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Division 27 – Communications governs the infrastructure for the low-voltage information transport systems, which include voice and data and their pathways.

B. Description of Work:

1. Furnish and install materials for the communications infrastructure systems as specified herein and as shown on the drawings. Upon completion, the systems shall be functioning in compliance with performance requirements specified.

2. The cabling specified and shown on the drawings is for complete, performance based, workable systems. Deviations from the cabling shown due to a particular manufacturer's requirements shall be made only with the written approval of the Architect and the Owner, and at no additional cost to the Owner.

3. This division also includes telecommunications cabling, connections, and equipment needed for the A/V projection and sound reinforcement and IP Video Camera cabling. Refer to “T” series drawings for locations, quantities and additional requirements.

1.02 SECTION INCLUDES

A. Definitions

B. Quality Assurance

C. Submittal Requirements

1.03 DEFINITIONS

A. Advanced System Warranty – an extended warranty held either by the connectivity or cabling manufacturer directly with the Owner for this project that guarantees product and performance of the entire cabling system for the warranty period.

B. Conveniently Accessible - being capable of being reached from floor or use of 8’ step ladder without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

C. Entrance Room – A space in which the joining of campus and building telecommunications backbone facilities takes place.

D. Equipment Room – An environmentally controlled centralized space for telecommunications equipment that usually houses a main or intermediate crossconnect, as well as video surveillance and security equipment.

E. IDF – Intermediate Distribution Frame, also known as a Telecommunications Room (TR) or Communications Room.

F. Lead Telecommunications Installer –the project manager for the Telecommunications Subcontractor for all telecommunications work in the construction documents (ET-series drawings and specification Section 27), who shall be on-site at all times while Division 27 work is being performed. This individual shall attend all construction project meetings.

G. Listed Communications Cable – A cable listed by the Underwriters Laboratory (UL®) and accepted by the local authority having jurisdiction as having met appropriate designated standards or has been tested and found suitable for installation in specific spaces. Refer to *NEC*® Section 800 for listing types and additional requirements.

H. MDF – Main Distribution Frame, also known as the Main Equipment Room.

I. Plenum – A compartment or chamber to which one or more air ducts is connected and that forms part of the air distribution system. Assume space above suspended/accessible ceilings is a plenum.

J. Plenum-rated – listed by the Underwriters Laboratory as being suitable for installation into a plenum space. Communications cabling routed through plenum-rated space shall be plenum-rated and identified as Type CMP.

K. Point of Entrance (Building Entrance) - The point within a building at which the Outside Plant (OSP) communications wire or cable emerges from an external wall, from a concrete floor slab, or from a rigid metal conduit (Type RMC) or an intermediate metal conduit (Type IMC) connected by a grounding conductor to an electrode in accordance with the *NEC*®.

L. Subcontractor, Telecommunications – company responsible for all telecommunications work in the construction documents (T-series drawings and specification sections 27 0000 through 27 5319).

M. Telecommunications – in general, telecommunications refers to infrastructure/equipment needed for the voice, data, and video communications and transport systems. N. Telecommunications Consultant – As defined for sections referring to telecommunications work only, this Consultant shall be the telecommunications design consultant employed by the Owner for the purpose of observing the work of the Communications Subcontractor(s).

O. Telecommunications Room - An environmentally enclosed architectural space designed to contain telecommunications equipment, cable terminations, or crossconnect cabling. The Main Equipment Room may also be known as the MDF, and may be co-located with the building's Entrance Room and Equipment Room. Telecommunications Rooms will also house equipment for additional systems, such as security, cable television, and audio/video.

P. UL® – Underwriters Laboratory

1.04 QUALITY ASSURANCE

A. Telecommunications Subcontractor Qualifications

1. Company Requirements

a) The Telecommunications Subcontractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications.

b) Telecommunications Systems specified shall be assembled and installed under the direction of a qualified Telecommunications Subcontractor.
Qualification requirements shall include submittal by the Telecommunications Subcontractor to the Architect of the following:

1) List of previous projects of this scope and nature, including names and sizes of projects (to include square footage and construction cost – overall and that of the Telecommunications Subcontractor), description of work, times of completion, and names of contact persons for reference.

2) Installers shall certify that they are manufacturer-authorized or trained for work to be performed.

2. Lead Telecommunications Installer Requirements:

a) Lead Communications Installer shall be a current member of BICSI in good standing and have completed (at a minimum) BICSI ITS Installer 2 Training (for both copper and fiber).

b) Submit certificate of ITS Installer 2 Training (or higher) with bid and preconstruction submittal package.

c) Advanced training from connectivity manufacturer may be submitted in lieu of BICSI ITS Installer 2 Training. Submit manufacturer training certificates for review by Owner as substitution request as part of Pre-Bid questions. This training must be by the same manufacturer that will hold the Advanced System Warranty.

3. General Telecommunications Installer Requirements:

a) For all work associated with Specification Sections 27 all installers are to have a minimum of BICSI ITS Installer 1 Training or equivalent training from the connectivity manufacturer.

b) Submit a list with bid of names of all installers and appropriate copies of certificates verifying training with pre-construction submittal package.

C. Warranty Requirements

1. Project Warranty

a) Equipment and materials required for installation under these specifications shall be the current model and new (less than one year from date of manufacture), unused and without blemish or defect, and are to be guaranteed to be free from defect.

b) When a defect or problem is observed within the first year after substantial completion, the Owner will notify the governing subcontractor through the proper channels. The appropriate Subcontractor then has 48 hours to fix the defect or furnish and install a replacement part/system, all at no cost to the project or Owner.

2. Advanced System Warranty for Telecommunications (Copper and Fiber Systems)

a) Beyond the initial one year project warranty, the Telecommunications Systems shall be warranted for a minimum of 25 years by a national and reputable connectivity or cabling manufacturer.

1) This warranty shall cover any material defect, as well as the performance of the cabling system. (Example: A Category 6A cabling system is to deliver 10,000BASE-T speed, or 10 “Gig” performance for the entire length of the warranty period.)

2) This warranty shall cover both material and labor for the full length of the warranty period.

b) Submit warranty certification for verification.

c) The Telecommunications Subcontract shall be certified by this manufacturer.

d) The following manufacturers are conditionally approved to provide the system warranties (subject to specific project requirements):

1) Copper Connectivity Manufacturers

i. CommScope/Systimax

ii. Panduit

2) Fiber Connectivity Manufacturers

i. Corning

ii. Panduit

3) Cabling Manufacturers

i. CommScope/Systemax

I. General (for Panduit product Set)

D. When articles, materials, operations or methods related to execution of communications work are noted, specified, or described in the specifications or are indicated or reasonably implied on drawings and schedules, execute work as required or appropriate to provide complete and proper function, operation and installation.

E. The drawings utilize symbols and schematic diagrams to indicate items of work. These symbols and diagrams will not typically identify dimensions nor will they identify inclusion of specific accessories, appurtenances and related items necessary and appropriate for a complete and proper installation and operation. The Telecommunications Subcontractor shall install work complete and ready for proper operation, including related items not specifically identified, shown, indicated or specified. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on architectural drawings and on shop drawings approved by the Telecommunications Consultant.

F. The drawings include details for various items, which are specific with regard to the dimensions and positioning of the work. These details are intended only for the purpose of establishing general feasibility; they do not obviate field coordination for the indicated work. Work shall not proceed until actual field conditions and requirements are verified by the Telecommunications Subcontractor.

G. The drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions.

1.05 SUBMITTALS

A. General Requirements

1. Provide Submittals in accordance with Section 01 3300
2. Architect shall receive and Telecommunications Consultant is to review all submittals related to Division 27 work. This includes, but is not limited to, relevant:
   a) Pre-bid questions,
   b) Contractor and personnel qualifications with bid,
   c) Voluntary alternates and unit pricings with bid,
   d) Pre-construction product submittals and shop drawings,
   e) Change order requests, requests for information (RFIs), design change directives (DCDs), and any other changes as directed by the architect/engineer.
3. Record drawings and warranty certificates/letters shall be in accordance with Section 01 7839.
4. Allow a minimum of one week (five working days) for the Telecommunications Consultant to review.

B. The following submittals are due at the Pre-Bid deadline for questions:

1. Requests for product substitution shall be in accordance with Section 01 6000
   a) All products seeking approval either as “approved equivalent” or otherwise, shall be submitted as a product substitution request prior to bid. Failure to submit product substitution request in a timely manner (before pre-bid questions are due) may preclude product from being utilized on the project. Requests made with bid or post-bid will not be considered without a significant cost savings realized to the Owner.

b) The burden of proof is on the contractor to provide documentation that equivalent product meets the specifications and project requirements. Include in substitution request:

1) Product being replaced

2) Reason for product substitution

3) Full manufacturer specification sheet clearly indicating that all requirements in project documents have been met

c) Failure to meet these requirements will result in the product substitution request being returned without review.

d) All product substitution requests are to be reviewed and approved by the Telecommunications Consultant. Not all requests will be approved, and all decisions are final, without recourse. C. The following submittals are due with the Bid:

1. Proof of Telecommunications Subcontractor and personnel qualifications

a) Provide a typed list with the following information:

1) Company name of Telecommunications Subcontractor

2) List of connectivity or cabling manufacturers that the Telecommunications Subcontractor is certified to install and provide advanced warranty for.

3) List of previous projects (minimum of 3) of this scope and nature, including:

I. Project name and date of completion

II. Project size (square feet of building, total construction cost, total cost of telecommunications scope)

III. Name and contact information for building owner or IT Manager

4) Name and contact information for Lead Telecommunications Installer

b) Provide certificates or letter(s) from BICSI and / or manufacturers verifying by name these qualifications have been met.

c) Refer to Quality Assurance subsection in this specification section for additional requirements and qualifications.

2. Voluntary alternatives (that realize substantial cost savings)

3. Unit pricing for the following items:

a) All unit pricing relating to Division 27 as identified in Section 01 2200.

D. The following submittals are due at the Pre-Construction Phase (to be delivered to the Project Architect with copies to Telecommunications Consultant):

1. General Requirements:

a) Follow submission guidelines as outlined in Division 1. At a minimum, provide the requirements as outlined in this section. Where Division 1 requirements are more stringent, follow those in addition to the requirements in this section.

1) Strictly electronic submission to Telecommunications Consultant is acceptable. General contractor, architect, and engineering requirements may differ.

b) Ensure a cover page with Project Title, Telecommunication

Subcontractor Company, and point of contact is included for all physical submittals.

c) Updated Personnel Qualifications

1) Provide a list of names of all telecommunications installers with appropriate certificates from BICSI or the manufacturer.

2. Product Information, divided by Specification Section and in order as listed in specification. Identify the start of each specification section.

a) Provide manufacturer's product information cutsheet or specifications sheet with the specific product number identified or filled out.

1) Submitted cutsheets without specific product identified will result in the whole submittal being returned without review.

2) No product substitutions will be considered post bid without a significant cost savings to the project to be realized by the owner – a minimum of $1000, either in material or labor savings. For any product substitution requests post-bid, Telecommunications Subcontractor shall submit an RFI through the proper channels with the requested documentation from the Pre-bid requirements above. Also, include realized cost savings. The project team may issue a change order (or its equivalent) for the product change at their discretion.

I. One exception to this is if the specified product goes out of production and is unavailable before submitted shop drawings are approved. Telecommunications or Subcontractor is to submit an RFI explaining the situation and recommending an equivalent product with the same features at no cost change to the project or Owner.

II. Other exceptions may be considered. Telecommunications Subcontractor is to submit an RFI explaining the situation.

3. Shop Drawings

a) Conform to all requirements of Section 01 3300. In n addition, generate electronic shop drawings in AutoCAD®, dwg file format, version 2004 (or newer), saved to disk (CD-R or DVD+/-R) or USB Flash Drive with project name and number clearly indicated [or uploaded to project website]. Shop drawings shall include Telecommunications or Subcontractor title block and included readily printable Plot/Drawing tabs with mview-window at a scale to not be less than 1/8"=1'-0" unless otherwise noted. The scale shall also be indicated on the drawings.

1) Acceptable electronic shop drawing sizes include: 8.5"x11", 11"x17", 22"x34" or 24"x36".

b) Refer to individual sections for additional requirements.

c) Communications pathways

1) Hangers and Supports – indicate proposed routing of all cabling supported by J-hooks or Hilti Cable Holder.

2) Cable Trays - indicate size and proposed routing of all communications cable trays; should any of those locations or sizes differ from the construction drawings due to minor coordination issues, cloud the affected area and note why the

change is necessary. (For major coordination issues, please submit an RFI.)

3) Firestopping – indicate manufacturer, product/assembly, and UL system for all firestop penetrations required for communications cabling.

E. The following submittals are due during Construction (project closeout), in accordance with the requirements in Sections 01 7839 and 27 0000 - Communications:

1. 3 weeks prior to Substantial Completion:

a) Record Drawings

1) Modify reviewed and accepted AutoCAD® shop drawings to include revisions based upon completion of work.

2) Provide (1) printed set of record drawings to scale (not less than 1/8" = 1'-0").

3) This set is to include system function diagrams and details not on original construction documents.

b) Test Results, in accordance with section 27 0800.

c) With the exception of the (1) printed set of record drawings, submit these files electronically either on disk (CD or DVD) or USB Flash Drive, with project name and number clearly indicated.

2. Within two weeks after Substantial Completion:

a) Warranty Certificates for the Advanced Telecommunications System Warranty for the copper and fiber systems with point of contact for any warranty claims.

1.06 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit required information for coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, fire alarm, plumbing, cable trays, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, electrical, fire alarm ceiling suspension and tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling and finishes), structural. mechanical, and electrical systems as submitted, including footings and foundation unless otherwise required by Division 00, Procurement and Contracting Requirements and/or Division 01, General Requirements, to combine information furnished by other trades onto master coordination documents.

B. Prepare Drawings as follows:

1. Provide drawings in Revit Model. Revit Model release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
2. Review and revise, as necessary, Section cuts in Contract Drawings after verification of field conditions.
3. Drawings to indicate proposed ceiling equipment, conduit and cable trays. Drawings to indicate proposed and identified structural members

to which hangers and sway braces will be attached as shown on structural drawings.

4. Incorporate Addenda Item and change orders.
5. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

E. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

B. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer and part number.

C. All products and materials shall be new and unused prior to their installation as part of this project. Refurbished items are not allowed.

PART 3 - EXECUTION

3.01 GENERAL

A. Coordinate with all other trades prior to installation.

1. Telecommunications Subcontractor shall meet with Electrical, Mechanical, and General Contractors prior to construction to identify pathway and infrastructure space requirements.
    a) At a minimum, the following items shall be discussed:
        1) Cable tray locations and clearance space above (12” if possible, with proper coordination)
        2) Placement for sleeving and wall penetrations
        3) In-ceiling projection screens and other audio/video equipment.
    b) Failure to coordinate sufficient space for telecommunications infrastructure shall result in relocation of various systems by the contractor at no additional cost to owner.
2. Prior to the start of work, the Telecommunications Subcontractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where Division 27 work may properly commence. Start of work indicates acceptance of conditions.
3. Coordinate location of equipment and conduit with other trades to minimize interference.
    a) Holes through concrete and masonry structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base building. Pneumatic hammer, impact

electric, hand or manual hammer type drills shall not be allowed, except where permitted by the General Contractor as required by limited working space.

b) Holes shall be located so as not to affect structural sections such as ribs or beams.

c) Holes shall be laid out in advance. The General Contractor shall be advised prior to drilling through structural sections, for determination of proper layout.

d) Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors, provide an effective barrier against the spread of fire, smoke and gases.

B. Follow all manufacturers' instructions and install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

1. In the event of discrepancy, immediately notify the Telecommunications Consultant through the proper channels. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

C. Protection of Systems and Equipment

1. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

2. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering them on sides with securely fastened protective rigid or flexible waterproof coverings.

3. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum-cleaned both inside (as appropriate) and outside before testing, operating or painting.

4. As determined by the Telecommunications Consultant, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Telecommunications Consultant shall be final.

5. Painted surfaces shall be protected with removable heavy kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.

6. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer.

D. Access to Equipment

1. Equipment shall be installed as per the scaled detail on the T-series Drawings. .
2. Working spaces shall be not less than specified in the National Electrical Code® for voltages specified.
3. Where the Telecommunications Consultant determines that the Telecommunications Subcontractor has installed equipment not “conveniently accessible” for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Telecommunications Consultant, at no additional cost to the Owner.

E. Cleaning

1. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.
2. Remove dust and debris from interiors and exteriors of telecommunications equipment (including electrical rough-in). Clean accessible current carrying elements prior to being energized.

F. Completion

1. General:

a) Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

2. Results Expected:

a) Systems shall be complete and operational. Cleaning

work shall be complete.

3. Testing and Verification – General Requirements

a) Refer to individual sections for additional testing and verification requirements.

b) The Telecommunications Subcontractor shall verify that requirements of this specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

c) Verification by Inspection: Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the specifications.

d) Verification by Test and Demonstration: The Telecommunications Subcontractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Communications Subcontractor shall demonstrate that the communications systems components and subsystems meet specification requirements in the "asinstalled" operating environment during the "System Operation Test".

e) Perform system operation tests after full enclosure of walls.

f) System Operation Tests Conducted Upon Completion of Work: Upon completion of the Telecommunications Subcontractor's Work, subject the

system to functional and operational tests. When required corrections determined by initial test results have been completed, fully retest the system. The Owner shall be notified in writing not less than seven days in advance of date of proposed final testing and inspection. The advance notice shall include certification that the installation is complete and operable and that the Telecommunications Subcontractor has satisfactorily performed the final tests specified herein. The acceptance testing and final inspection shall be accomplished in the presence of the Owner and the Telecommunications Consultant. At least 10 days prior to scheduled system completion, the Telecommunications Subcontractor shall submit, for approval by Owner and Telecommunications Consultant, a test plan to completely test the telecommunications system. The Telecommunications Subcontractor shall include in test plan, for acceptance by the Owner and Telecommunications Consultant, a complete and detailed final acceptance test check-off list ("punch list"). The list shall be a complete representation of specified functions and conditions.

4. Commissioning

a) There shall be three phases of commissioning:

1) Rough-in inspection

2) Above-ceiling inspection (after cables are placed)

3) Final inspection

b) At a minimum, the Telecommunications Consultant shall check the following items:

1) Accurate location and height above finished floor for all outlet boxes.

2) Accurate dimensions (particularly depth) of all outlet boxes and diameter of in-wall conduit serving outlet boxes.

3) Cable tray size, location, and clearance.

4) Location and size of all other communications conduits or pathways

5) That power receptacles within the communications rooms meet the design requirements.

6) The Telecommunications Consultant is then to issue a written report to the Architect identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed.

This report is not necessarily all inclusive; should issues be discovered later in the project, the appropriate communications subcontractor is still responsible for corrections/repairs.

c) Once all communication cabling has been installed and properly supported and walls have been painted, but prior to the installation of ceiling tiles/material, the Telecommunications Consultant shall schedule a time to be on-site to conduct above-ceiling inspection.

1) At a minimum, the Telecommunications Consultant shall check the following items:

i. That all items from the previous inspection have been corrected.

ii. That communications cabling is routed correctly and adequately supported.

iii. That communications cabling is not painted or over sprayed.

iv. That the installed communications cabling matches what was specified / submitted.

v. That there are no kinks, splices, or other damage to the installed communications cabling.

2) The Telecommunications Consultant is then to issue a written report to the Architect identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed. This report is not necessarily all inclusive; should issues be discovered later in the project, the appropriate communications subcontractor is still responsible for corrections/repairs.

d) Once all communications work has been completed, contractor shall request final inspection. This request shall be made 3 weeks before substantial completion. The Telecommunications Consultant shall then schedule a time to be on-site to conduct this inspection; the Telecommunications Consultant shall also invite the Owner to attend this inspection.

1) At a minimum, the Telecommunications Consultant shall check the following items:

I. That all items from the previous inspections have been corrected

II. That all faceplates are installed, with the correct modules, quantity of modules, and approved labeling scheme

III. That all equipment and cabling within communications rooms is installed per the contract documents, including all patch panels and wall blocks (with specified spare capacity), horizontal and backbone cabling labeling, and telecommunications grounding.

IV. And all other items necessary to guarantee contract documents are met and complete and functioning communications systems are installed.

2) The Telecommunications Consultant is then to issue a written report to the Architect identifying all items which currently do not meet the construction document requirements. This report is to be forwarded to the appropriate subcontractor(s) and all items are to be addressed prior to substantial completion. This report is not necessarily all-inclusive; should issues be discovered within one year after substantial completion, the appropriate communications subcontractor is still responsible for corrections/repairs.

END OF SECTION

SECTION 27 0126
SUBMITTALS AND SHOP DRAWINGS

PART 1 GENERAL

1.01 REQUIREMENTS

A. Refer to General Divisions for submittal requirements and procedures.

1.02 DEFINITIONS

A. Manufacturer's Product Data: Manufacturer's product data consist of one or more levels of manufacturer's information as described below and as requested in the submittal schedule. The three levels of information include: manufacturer's list, manufacturer's catalog data, and manufacturer's technical and engineering data.

1. Manufacturer's List: Manufacturer's list shall include a typewritten list of manufacturer's name, sizes and model or catalog numbers, referenced to the specification section.
2. Manufacturer's Catalog Data: Manufacturer's catalog data shall include standard catalog information marked to indicate specific equipment proposed and point of operation, if appropriate. Include installation instructions.
3. Manufacturer's Technical and Engineering Data: Manufacturer's technical and engineering data shall include materials, dimensions, details, installation instructions, weights, capacities, illustrations, wiring diagrams, control diagrams, piping diagrams, connection diagrams, performance data (including performance curves), mix design, and any other information required for a complete and thorough evaluation of the equipment or items specified, and to verify compliance with specifications. Control diagrams or control schematics, where specified and required by the submittal schedule, shall include a detailed schematic of the proposed control modifications and their interface with existing control equipment, where appropriate, and a manufacturer and model number listing of all proposed control components shown on the control schematic.

B. Shop Drawings: Shop drawings are construction drawings of items manufactured specifically for this project. Shop drawings include dimensions, construction details, weights, and additional information to identify the physical features of the system or piece of equipment.

C. Samples: Samples illustrate functional characteristics of the product with integral parts and attachment devices. Samples shall allow evaluation of full range of manufacturer's standard colors, textures, and patterns.

D. Certificates, Test Data or Other Information: Requirements for certificates, test data, or other information will be listed under referenced specification sections.

1.03 SUBMITTALS REQUIRED

A. Product Evaluation Data. The submittal schedule for product evaluation data is as indicated below. Each item requiring a submittal is given the following code:

1. Manufacturer's list
2. Manufacturer's catalog data
3. Manufacturer's technical and engineering data
4. Shop drawings
5. Samples
6. Certificates
7. Test data
8. Worker's qualifications

9. See individual sections for special requirements

1.04 SUBMITTAL SCHEDULE

Division 27 – Communciations	Codes
Section 27 0536 – Cable Trays for Communications Systems	1,2,3
Section 27 1000 – Access Control and Intrusion	2,3
Section 27 1126 – Rack Mounted Power Protection	2,3,4
Section 27 1313 – Copper Backbone Cabling	2,3
Section 27 1323 – Optical Fiber Backbone Cabling	2,3
Section 27 1513 – Copper Horizontal Cabling	2,3
Section 27 2000 – Voice and Data Communications	2,3
Section 27 5113 – Intercommunication Systems	2,3
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PART 2 PRODUCTS

2.01 THIS PART NOT USED

PART 3 EXECUTION

3.01 THIS PART NOT USED

END OF SECTION

SECTION 27 0500

COMMON WORK RESULTS FOR COMMUNICATION

PART 1 GENERAL

1.01 CONTRACT DOCUMENTS

A. The Contract Documents are complementary. What is required by any one, as affects this Division, shall be as binding as if repeated herein.

B. Separation of this Division from other Contract Documents shall not be construed as complete segregation of the Work.

C. Particular attention is called to Advertisement For Bids, Instructions to Bidders, Supplemental Instructions to Bidders, General Conditions, Supplemental General Conditions, Drawings and Specifications, and modifications incorporated in the documents before execution of the Agreement.

1.02 BASIC COMMUNICATION REQUIREMENTS

A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture.

B. The Contractor shall field-investigate this facility to ascertain the exact physical and electrical conditions in the main Equipment Room (MDF), and the Telecommunications Room (IDF) locations to become familiar with the physical environment of the building.

C. The Contractor shall provide, install, and test the entire cable infrastructure as described under this contract.

D. The Contractor shall call attention to the Owner any error, conflict, or discrepancy in Plans and/or Specifications. Do not proceed with any questionable items of work until a resolution or clarification has been made. Supplemental Plans and Specifications may be supplied as required and shall become part of the Contract Documents.

1.03 SCOPE OF WORK

A. General: Provide and install complete and satisfactorily operating communications systems as specified in this Division, as shown on Drawings, as required, and as reasonably intended. Work generally includes, but is not limited to communication and alarm systems.

B. Omissions: Omission of expressed reference to any item of labor or material necessary for the proper execution of the work shall not relieve responsibility from providing such additional labor or material.

1.04 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where

"approved equal" is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.

C. Strictly adhere to all Telecommunications Industry Association (TIA) and BICSI recommended installation practices and manufacturer's guidelines when installing communications components.

1.05 MANUFACTURER'S WARRANTY CERTIFICATION

A. The manufacturer's certification must be supported by Contractor's successful completion of an installation class recognized by an independent organization (such as BICSI or an accredited school). A written test is strongly preferred.

1.06 TECHNICAL QUALIFICATIONS

A. Contractor must be certified by manufacturer as able to provide a 20 year (minimum) manufacturer's warranty certificate.

B. A minimum of three references demonstrating Contractor's past installation experience in Certified Category 6A systems in similar facilities with a minimum of 500 nodes shall be submitted. The Contractor must supply a one year warranty upon completion of the job.

C. At least 50% of the technicians, to include all on-site Journeymen Electricians, must have successfully completed the manufacturer's warranty certification class. D. All Journeymen are to possess a current Oregon License.

E. All Apprentices are to be actively enrolled in an Oregon State approved electrical apprenticeship program.

F. All Equipment/Telecommunication Room and Telecommunications Outlet equipment shall be installed and tested on-site by a technician(s) who, by virtue of an acceptable training course or documented experience, is qualified to perform these procedures. Acceptable training may include successful completion of the manufacturer's training course, documented on-the-job experience or successful completion of applicable technical courses in a recognized trade school.

G. Verification of the above requirements must be submitted in writing with bid.

1.07 CERTIFICATES

A. Contractor must provide evidence of ability to provide a Manufacturer's Certificate of Warranty for the system bid.

B. Contractor must provide Technician Certificate(s) for the 50% mentioned above.

1.08 EXAMINATION OF SITE

A. Examine Site of Work before making Bid and ascertain all related physical conditions.

B. Field verify scale dimensions shown since exact locations, distances and levels will be governed by actual field conditions.

C. Owner will not be responsible for any loss or unanticipated costs which may be suffered by the successful Bidder as a result of such Bidder's failure to fully inform himself in advance in regard to all conditions pertaining to the Work and character of the Work.

1.09 COORDINATION OF TRADES

A. Check Drawings of other trades to avert possible installation conflicts. Should major changes from original Drawings be necessary to resolve such conflicts, notify Architect and secure written approval and agreement on necessary adjustments before installation is started.

B. Check equipment connections and equipment locations on the job for coordination with other Divisions equipment and connections, structure, and the like.

1.10 MINOR DEVIATIONS

A. Make minor changes in equipment connections and equipment locations as directed or required before rough-in without extra cost.

1.11 SUBSTITUTIONS

A. Equal material of other manufacturer may be used following Architect's approval of a written request submitted at least 7 working days prior to bid date.

1.12 RECORD DRAWINGS

A. Maintain a marked set of prints at job site at all times. Show all changes from contract drawings, whether visible or concealed. Dimension accurately from building lines, floor or curb elevations. Show exact location, elevation, and size of conduit, access panel and doors, and all other information pertinent to the work.

B. At project completion, submit marked set to Architect for approval.

1.13 WARRANTY

A. Warrant all work, materials, and equipment for one year.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number herein is for the purpose of establishing the product set, which the Contractor is to supply and install.

B. Quantities are to be determined by Contractor unless specified.

C. Products shall be UL® listed for the purpose they are to be used.

2.02 PRE-APPROVED PRODUCTS

A. The following products are pre-approved for this project. Except as noted, all others will require a substitution request to be completed and approved as per these documents. The District will not consider product sets that have not been pre-approved or accepted as per the substitution request process. Refer to individual sections for additional information and product requirements.

1. Structured Cable Systems:

   a. CommScope/Systemax - all category 5e, 6 and category 6A components, i.e., jacks, patch panels, patch cords and fiber optic components.

   b. Fiber – Corning.

   c. Panduit - all category 5e, 6 and category 6A components, i.e., jacks, patch panels, patch cords and fiber optic components. Partner cable, i.e., General is acceptable for the Panduit solution.

2. Racks, cabinets, frames and associated fastening devices

   a. Chatsworth Products Incorporated (CPI)

   b. Hoffman

2.03 FIRESTOPPING

A. Comply with the requirements of Section 07 8400

B. Products may be in the form of caulk, putty, strip, sheet, or devices that shall be specifically designed to fill holes, spaces, and voids at communications penetrations.

B. Firestopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits and cables.

2.04 ACOUSTIC SEPARATION

A. Acceptable products for 2” through 4” penetrations are as follows

1. STI EasyPath™

2. Resilient latex caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.

3. Or approved substitution

B. Acceptable products for less than 2” penetrations are as follows

1. Resilient latex caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.

2. Or approved substitution

2.05 CABLE SYSTEM

A. Refer to additional specification sections and Drawings for cable types and quantities.

B. Cable System Color coding:

Security and Access Control	Orange	Per Specs
Cameras	Green	CAT 6A
Data / WAPs	Yellow	CAT 6A
Underground Data/Telecom	Black	
Wireless Access Points (WAP)	Yellow	CAT 6A
Intercom/Speakers/Clocks/Bells	Grey	Per Specs
Fire Alarm	Red	Per Specs

2.06 OWNER FURNISHED EQUIPMENT

A. Cisco switches are Owner Furnished, Owner Installed (OFOI).

B. Wireless Access Points are Owner Furnished, Contractor Installed (OFCI). Install access points, mounting bases and any required protective covers.

C. Cameras are Owner Furnished, Owner Installed (OFOI).

PART 3 EXECUTION

3.01 THIS PART NOT USED

END OF SECTION

SECTION 27 0526

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL REQUIREMENT

1.01 SUMMARY

A. This section includes the grounding and bonding requirements for the metallic components located in the Telecommunications Rooms.

1.02 SCOPE

A. Provide all labor, materials, tools, and equipment required for the complete installation of a telecommunications grounding system.

1.03 QUALITY ASSURANCE

A. All grounding and bonding cables shall be installed in a neat and workmanlike manner. C. Grounding shall meet applicable ANSI/TIA-607-B, NEC Articles 250 and 800 requirements and practices except where other authorities or codes may impose a more stringent requirement or practice. All racks and cable trays shall be bonded to a ground bar with #6 AWG cable. All termination equipment shall be grounded according to the specifications of the manufacturer.

B. Impedance shall not exceed 5 Ω between any two metallic points within a Telecommunications Room.

PART 2 - PRODUCTS

2.01 TELECOMMUNICATIONS MAIN GROUND BUS BAR – MAIN EQUIPMENT ROOM - MDF

A. A 4” x 12” x ¼” Copper bar is to be provided by Division 26. Coordinate locations with Division 26 Contractor.

2.02 GROUND BUS BAR – TELECOMMUNICATIONS ROOM - IDF

A. A 2” x 10” x ¼” Copper bar is to be provided by Division 26. Coordinate locations with Division 26 Contractor.

2.03 CABLE RUNWAY GROUNDING STRAPS

A. Continuous #6 AWG with two hole compression lugs, Chatsworth 40164-001 or approved alternate.

B. #6 AWG from bench stock is acceptable with machine compression or exothermically applied lugs.

PART 3 - EXECUTION

3.01 GENERAL

A. A copper grounding and bonding system shall be installed which places a properly sized (as per Table 250-122 of National Electrical Code) copper cable in the immediate vicinity of the telecommunications backboard. Contractor shall be responsible for placement of the above referenced ground bus bars and terminal as well as their connection to the building system grounding cable using an exothermic-welded type connector or appropriate compression applied connector to satisfy the Authority Having Jurisdiction.

3.02 PREPARATION

A. Preparation of surfaces: Clean contacting surfaces of ground connections to bright metal before connecting

B. When making bolted connection to aluminum or galvanized structures, apply a corrosion inhibitor such as Penetrox A to contact surfaces between connector, and surface of structure.

3.03 INSTALLATION

A. Grounding shall meet applicable ANSI/TIA-607-B, NEC® Articles 250 and 800 requirements and practices except where other authorities or codes may impose a more stringent requirement or practice. All racks and cable trays shall be bonded to a ground busbar with #6 AWG cable. All termination equipment shall be grounded according to the specifications of the manufacturer.

B. All metallic components that make up the equipment racks and ladder rack shall be bonded together in a manner that provides continuous continuity between the components. Attention must be given to the removal of paint of powder coating to present bare metal where bonding straps are fastened to the metallic component.

END OF SECTION

SECTION 27 0528

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL REQUIREMENT

1.01 GENERAL

A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section. B. This section and all related sections shall be performed by a qualified Contractor as outlined in the specifications.

1.02 DESCRIPTION OF WORK

A. This contract shall be responsible for all hangers and support mechanisms required to properly support all telecommunications cables to satisfy the local Authority Having Jurisdiction.

B. This contract shall be responsible for all pathways as called out on Drawings, specifically:

1. Various conduits and “J-Boxes” as detailed on “T” and “ET” series Drawings to accommodate Telecommunications Outlets (TO) and Wireless Access Points (WAP) locations. Any necessary penetrations shall accommodate a minimum of a Trade Size 1 EMT conduit.
2. Surface mounted raceway, as per “T” and “ET” series Drawings

C. The Contractor shall coordinate with the General Contractor and all other trades prior to final placement of telecommunications pathways. Placement shall be such that pathway will be accessible for future additions requiring placement of telecommunications cable. D. The Contractor shall provide all labor, equipment and supplies to furnish and install the communications pathway, hangers and supports.

E. Installation shall include the actual physical installation of the hardware and/or support structure, firestopping, testing and documentation.

PART 2 - PRODUCTS

2.01 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. Products are to be from the acceptable manufacturer listed below or an approved alternate. In no case will field fabrication or “shop built” cable support products be acceptable.

2.02 SURFACE MOUNTED RACEWAY

A. Surface Mounted Raceway (SMR) shall be provided as per Section 27 0528.39 with all fittings including but not limited to mounting clips and straps, couplings, flat, bend limiting internal and external elbows, cover clips, bushings, device boxes and other incidental and miscellaneous hardware required for a complete SMR system.

2.03 J-HOOKS

A. J-hooks shall be constructed of galvanized steel or hot dipped zinc.

B. Fastener is to be installed using dedicated wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments. Product is to be UL® Listed for the application.

C. Acceptable products: CADDY® CABLECAT – Wide Base Cable Support.

2.04 ADJUSTABLE CABLE SUPPORT SYSTEM

A. Cable support system shall be a factory produced assembly and sized to accommodate 100 percent expansion, i.e., rated to hold double the number of initially installed cables.

B. Acceptable product is: CADDY® CABLECAT Adjustable Cable Support

2.05 ROD MOUNTED CABLE SUPPORT SYSTEMS

A. Acceptable product is: CADDY® CAT-CM Cable Support System

2.06 FIRESTOPPING SYSTEMS TELECOM RACEWAYS

A. Comply with the requirements of Section 07 8400

B. Acceptable products for 2” through 4” penetrations are as follows

1. STI EasyPath™
2. Resilient elastomeric caulk and re-enterable putty manufactured by 3M™, Specified Technologies or Hilti.

C. Acceptable products for less than 2” penetrations are as follows

1. Resilient elastomeric caulk and re-enterable putty manufactured by 3M, Specified Technologies or Hilti.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install per manufacturer’s instruction per weight loading.

B. Install in accordance with directions given in Section 27 0529

C. SMR shall be securely supported using mechanical fasteners at intervals not exceeding 10 feet or in accordance with manufacturer’s installation instructions.

D. Telecommunication Outlets shall be surface mount outlet boxes compatible with the raceway specified.

E. The path of the SMR shall minimize impact on molding, tack boards and other architectural elements. Vertical runs of raceway from the ceiling to outlets shall be installed on walls near corners wherever possible. Raceway may be installed horizontally at the same height as the outlets or near to the ceiling. Entrance end fittings will be supplied at the ends of raceway runs to transition to conduit sleeves through walls, ceilings or floors. SMR shall be installed parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

F. Metal components shall be bonded and grounded in accordance with applicable code and ANSI/TIA-607-B.

G. J-hooks are to be supported by dedicated wires or rods installed by this contract. In no case will ceiling grid wires be used to support J-hooks. J-hooks will be attached to ceiling grid wires (where applicable) to satisfy seismic bracing requirements and to prevent swinging.

H. Adjustable cable support systems are to be securely attached to building structure and loaded as per manufacturer’s instruction.

I. Fire Rated wall and floor penetrations shall be fire-stopped in accordance with the manufacturer’s instructions using the product set referenced in 2.06 above.

END OF SECTION

SECTION 27 0529

HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Raceway Supports

PART 2 PRODUCTS

2.01 RACEWAY SUPPORTS

A. Single Runs: Steel rod hangers, galvanized single hole conduit straps, or ring bolt type hangers with specialty spring clips. Plumbers perforated tape or "J-nails" not acceptable.

B. Multiple Runs: Conduit rack with 25 percent spare capacity. Maximum width per manufacturer's recommendations.

C. Vertical Runs: Channel support with conduit fittings.

D. All hardware such as inserts, straps, bolts, nuts, screws and washers shall be galvanized or cadmium-plated steel.

2.02 ANCHOR METHODS

A. Hollow Masonry and Framed Walls: Toggle bolts or spider type expansion anchors

B. Solid Masonry: Lead expansion anchors or preset inserts

C. Metal Surfaces: Machine screws, bolts, or welded studs

D. Wood Surfaces: Wood screws

E. Concrete Surfaces: Self-drilling anchors or powder-driven studs

PART 3 EXECUTION

3.01 INSTALLATION

A. Layout to maintain headroom, neat mechanical appearance, and to support equipment loads required.

B. Exact location and spacing between supports per manufacturer's recommendations and NEC requirements as minimum.

C. Conduit shall be installed in such a manner as to prevent the collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps wherever possible.

END OF SECTION

SECTION 27 0533
RACEWAYS AND BOXES FOR COMMUNIATIONS SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Conduit, Tubing, and Fittings

B. Flexible Conduit

C. Electrical boxes and fittings as required for a complete installation

1.02 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA)

1. NFPA 70 National Electrical Code--Chapter 3

PART 2 PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. Conduit and Tubing: Galvanized steel rigid threaded conduit, electrical metallic tubing, intermediate metallic conduit.

B. Fittings:

1. General: Approved for purpose. Water, concrete tight where required.
2. Galvanized Rigid Steel Conduit (GRC): Threaded - no pressure type. Bushings with factory insulated throat.
3. Electrical Metallic Tubing (EMT): Connectors and couplings to be case steel. Preinsulated connectors and couplings shall be compression, setscrew type. All connectors shall have insulated throats.

C. Expansion Joints: Offset or sliding type with bending straps and clamps. Approved for purpose.

2.02 TYPE

A. Utilize GRC or IMC in concrete with concrete-tight connectors or exterior with watertight connectors.

B. Utilize electrical metallic tubing concealed in interior spaces or exposed in unfinished interior where not subject to physical damage.

C. Utilize surface metal raceways for exposed runs in finished areas. Paint to match wall finish.

D. Utilize Schedule 40 PVC where permitted. Suitable for use with 90 degree C wire and UL listed for above and below ground use. Provide “long-sweep” elbows.

2.03 BOXES

A. Minimum Box: 4-inch box, 1-1/2-inches deep, increase depth where required for installation of multiple conduits and conductors. Provide raised covers on bracket surface mounted outlet and plaster rings on flush outlets.

B. Three or More Devices at One Location: Use one piece gang boxes with device cover. Install one device per gang.

C. Provide galvanized steel interior outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.

D. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations. Choice of accessories is Installer's option.

2.04 PULLBOXES

A. Pullboxes and Junction Boxes: Sheet metal (indoors) or cast metal (exterior or damp locations) construction, conforming to National Electrical Code, with screw-on cover.

B. Flush Mounted Pullboxes: Provide overlapping covers with flush-head retaining screws, finished in light gray enamel.

C. Box volumes shall meet NEC for size and number of entering conduits.

2.05 SURFACE MOUNTED RACEWAY

A. Surface Mounted Raceway (SMR) shall be provided as per Section 27 0528.39 with all fittings including but not limited to mounting clips and straps, couplings, flat, bend limiting internal and external elbows, cover clips, bushings, device boxes and other incidental and miscellaneous hardware required for a complete SMR system.

2.06 J-HOOKS

A. J-hooks shall be constructed of galvanized steel or hot dipped zinc.

B. Fastener is to be installed using dedicated wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments. Product is to be UL® Listed for the application.

C. Acceptable products: CADDY® CABLECAT – Wide Base Cable Support.

2.07 ADJUSTABLE CABLE SUPPORT SYSTEM

A. Cable support system shall be a factory produced assembly and sized to accommodate 100 percent expansion, i.e., rated to hold double the number of initially installed cables.

B. Acceptable product is: CADDY® CABLECAT Adjustable Cable Support

2.08 ROD MOUNTED CABLE SUPPORT SYSTEMS

A. Acceptable product is: CADDY® CAT-CM Cable Support System

PART 3 EXECUTION

3.01 GENERAL

A. Install per manufacturer’s instruction per weight loading.

B. Install in accordance with directions given in Section 27 0528.39

C. SMR shall be securely supported using mechanical fasteners at intervals not exceeding 10 feet or in accordance with manufacturer’s installation instructions.

D. Telecommunication Outlets shall be surface mount outlet boxes compatible with the raceway specified.

E. The path of the SMR shall minimize impact on molding, tack boards and other architectural elements. Vertical runs of raceway from the ceiling to outlets shall be installed on walls near corners wherever possible. Raceway may be installed horizontally at the same height as the outlets or near to the ceiling. Entrance end fittings will be supplied at the ends of raceway runs to transition to conduit sleeves through walls,

ceilings or floors. SMR shall be installed parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

F. Metal components shall be bonded and grounded in accordance with applicable code and ANSI/TIA-607-B.

G. J-hooks are to be supported by dedicated wires or rods installed by this contract. In no case will ceiling grid wires be used to support J-hooks. J-hooks will be attached to ceiling grid wires (where applicable) to satisfy seismic bracing requirements and to prevent swinging.

H. Adjustable cable support systems are to be securely attached to building structure and loaded as per manufacturer's instruction.

I. Fire Rated wall and floor penetrations shall be fire-stopped in accordance with the manufacturer's instructions using the product set referenced in 2.06 above.

3.02 RACEWAY INSTALLATION

A. Install conduit concealed in all areas excluding mechanical and electrical rooms, connections to motors, connections to surface cabinets, underfloor spaces, and above suspended ceilings.

B. For exposed runs, attach surface mounted conduit with clamps.

C. Run raceways in concrete deck of floor above in areas of exposed structure at 1st floor ceilings. Elbow down to devices on underside of exposed structure. Refer to Architectural for details of floor assembly.

D. Route raceways at wood roof deck locations through roof insulation.

E. Coordinate installation of conduit in masonry work.

F. Install conduit free from dents and bruises. Plug ends to prevent entry of dirt or moisture.

G. Clean out conduit before installation of conductor.

H. Alter conduit routing to avoid structural obstructions, minimizing crossovers. Bends and offsets shall be avoided where possible, but when necessary shall be made with an approved hickey or conduit bending machine. The use of a pipe tee or a vise for bending conduit will not be permitted.

I. Provide UL approved expansion fittings complete with grounding jumpers where conduits cross building expansion joints and for long runs where conduit expansion may be excessive. Provide bends or offsets in conduit adjacent to building expansion joints where conduit is installed above suspended ceilings.

J. Route all exposed conduits parallel or perpendicular to building lines.

K. Allow minimum of 6 inches clearance at flues, steam pipes, and heat sources.

L. Vertical Runs: Straight and plumb.

M. Raceways Running in Groups: Run at same relative elevation, properly spaced and supported.

N. Dissimilar Metals: Avoid contact with pipe runs of other systems.

O. Lengths and Bends: Maximum number of bends in any run shall be the equivalent of four quarter bends (360 degrees total). Maximum length of any run shall be 300 feet, less 50 feet for each equivalent quarter bend. Junction and pull boxes shall be provided to maintain these limits.

P. Provide waterproof seal for all exterior wall and underground raceway penetrations.

Q. All empty raceways shall be provided with pull string or #12 conductor.

3.03 BOX INSTALLATION

A. Locate outlet boxes flush in areas other than mechanical rooms, electrical rooms, and above suspended ceilings.

B. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.

C. Coordinate location and mounting heights with built-in units. Adjust outlet mounting height to agree with required location for equipment served.

D. Locate pullboxes and junction boxes above suspended ceilings or in electrical rooms, utility rooms, or storage areas.

E. Support: Secure boxes independent of entering conduits by attaching directly to structure with bar hanger, blocking, or flat side bracket.

F. Identify each junction and pullbox with system description including branch circuit numbers of enclosed circuits.

G. Conduit shall be securely fastened to all sheet metal outlet, junction, and pullboxes with galvanized locknuts, and bushing.

H. Do not mount boxes back-to-back. Boxes on opposite sides of wall shall be separated by at least 3 inches.

END OF SECTION

SECTION 27 0536

CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish and install complete system.
2. System to include cable tray, supports, fire wall penetrations and all other necessary accessories and installation material.

1.02 QUALITY ASSURANCE

A. Acceptable Manufacturers: Cooper B-Line, SnakeTray, or approved.

B. Reference Standard: Conform with minimum recommendations of NEMA #VE-1.

PART 2 PRODUCTS

2.01 WIRE BASKET CABLE TRAY

A. Provide wire basket cable tray of types and sizes indicated with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the additional construction highlighted in Section 2.02.

B. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.

C. Wire basket cable tray shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section. D. Wire basket cable tray sizes shall conform to the following nominal criteria:

1. Straight sections shall be furnished in standard 118.3 inch lengths.
2. Wire diameter shall be 0.196” (5mm) minimum on all mesh sections (minimum size of 4.5mm on stainless steel).
3. Wire basket cable tray shall have a 4 inch usable loading depth by 12 or 18 inches wide as called out on Drawings.

E. In order for a system to be approved as an equipment ground conductor (EGC), all splicing assemblies shall be UL® Classified or CSA approved as an EGC. When using powder coated wire mesh cable tray as an EGC, the paint must be completely removed at all contact points of splice/ground bolt attachments.

F. Material and Finishes: Material and finish specifications for are as follows.

1. Non-exposed cable tray shall be bright zinc plated, as manufactured.
2. In exposed areas, not exposed to view, the cable tray shall be white powder coat. In exposed areas, subject to view, the cable tray shall be custom powder coated to match dark grey ceiling color. Straight sections shall be powder coated with an average paint thickness of 1.2mils (30microns) to 3.0mils (75microns). Field paint supports, hangers, and accessories to match tray color.

G. All fittings shall be field formed from straight sections in accordance with manufacturer’s instructions. Where exposed, white touch-up matching powder coat shall be applied to conceal bright edges.

H. Wire basket cable tray supports shall be “L” shaped wall brackets from the manufacturer of the tray.

I. Non-wall support hangers shall be supported by ¼” inch or 3/8” inch diameter rods.

J. Special accessories shall be furnished as required to protect, support and install a wire basket cable tray system.

2.02 FIRE WALL PENETRATIONS

A. Nelson "MCT Multi-Cable-Transit", O.Z./Gedney "Fire-Seal", or approved.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wire basket cable tray in accordance with NEMA VE 2 to ensure that the cable tray equipment complies with the requirements of the *NEC*®, applicable portions of NFPA 70B, and the National Electrical Contractors Association’s (NECA) ‘Guide to Quality Electrical Installations’ pertaining to general electrical installations practices.

B. All trays should be supported using a minimum of ¼” All Threaded Rod (ATR).

C. Special accessories shall be furnished as required to protect, support and install a wire basket cable tray system.

D. Coordinate wire basket cable tray with other electrical work as necessary to properly interface installation of wire basket cable tray with other work.

E. Support trays and fasten to structure. Install supports at each connection point, at end of each run, and at other points to maintain spacing between supports of 5 feet maximum.

F. Install firestopping in accordance with local and NFPA regulations to sustain ratings when passing wire basket cable tray through fire-rated elements.

G. Ground and bond metal cable tray in accordance with NFPA 70, National Electrical Code Article 392: Cable Trays. Additionally;

1. Bond cable tray system to a known source of building ground.
2. Provide continuity between wire basket cable tray components. Powder coating must be thoroughly removed at grounding device connection point.
3. Make connections to tray using mechanical, compression or exothermic connectors.
4. If required, ground cable trays by mounting up to two #6 AWG bare copper wires to each wire basket cable tray section, bonded with a grounding clamp

H. Provide sufficient space encompassing wire basket cable tray to permit access for installing and maintaining cables.

END OF SECTION

SECTION 27 0553

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL REQUIREMENT

1.01 WORK INCLUDED

A. Provide all labor, materials, tools, and equipment required for the complete labeling of the telecommunications infrastructure.

1.02 SCOPE

A. This section includes all telecommunications cables and the associated infrastructure in the telecommunications rooms and telecommunications cabinets.

1.03 QUALITY ASSURANCE

A. All cable identification tags and labels shall be installed in a neat and workmanlike manner.

PART 2 - PRODUCTS

2.01 LABEL TAGS – CABLE AND FACEPLATES

A. The labels shall be machine generated.

B. The label background shall be white with either black or blue ink.

C. Lettering on sleeves shall be $^{1}/_{8}$-inch high

2.02 ENGRAVED SIGNAGE

A. Engraved signage shall be laminate (color as specified) with engraved white letters.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. All horizontal (station) cables and outlets in which they terminate shall be identified by the Contractor at both ends of the wiring run. The standard nomenclature for the labeling is Number, IDF, patch panel-port number, hereafter known as CN.P.NN.
2. All fiber tie cables shall be labeled at each end. The standard nomenclature for labeling is “From <Room-1> to <Room-2>”, where “Room-1” is the originating location and “Room-2” is the destination.
3. Room numbers used for equipment labeling are to reference Architectural Signage Plans.

B. Telecommunication Room and Telecom Enclosures shall be identified with building room numbers

C. Horizontal (Station) Cables

1. All cables will be labeled the same at both ends. The tag shall be secured to the sheath no more than 4 inches from the end of the cable. Each end of the UTP horizontal cables shall be labeled with the nomenclature “CN.P.NN”. Where CN indicates the Room Number, IDP, Patch panel-port number.

2. Relative position identification shall commence to the immediate left of the entrance door with the position identifier starting at “A” and increasing through the alphabet in a clockwise direction.
3. Port numbers shall be “1” – “x”, where x is the total number of ports on a plate.
4. Examples;
    i. 101-A-1-P5-3 - would be the first telecommunications outlet in room 101 and have three ports
    ii. 101-B-1 P5-4 - would be the second telecommunications outlet in room 101 and have four ports
    iii. 101-C-1 P5-2 - would be the third telecommunications outlet in room 101 and have two ports

D. Copper Tie Cables

1. Cables shall be labeled “From” – “To”,

   specifically: From ER to TR-x, where “x” = TR

   Number

E. Fiber Tie Cables

1. Cables shall be labeled “From” – “To”,

   specifically: From ER to TR-x, where “x” = TR

   Number

F. Telecommunication Outlets (TO)

1. Each TO shall be labeled at the top of the modular jack enclosure with the Room Number-IDF Patch panel-Port number nomenclature.

G. Telecommunications Racks and Frames

1. Labeling in the Main Equipment Room and Telecommunications Rooms shall be as per the Drawings. Labels shall be 1” black laminate with ½ inch white letters. Labels shall be placed left-to-right identifying “FRAME-1” through “FRAME-x”, where “x” = number of racks/cabinets present.

H. Patch Panels

1. Patch panels shall be labeled identical to the cables and telecommunications outlets.

I. Door Signage

1. The exterior door of the Main Equipment Room (ER) and Telecommunications Rooms (TRs) shall have signage as per the drawings.

END OF SECTION

SECTION 27 1126

COMMUNICATIONS RACK MOUNTED POWER PROTECTION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

B. Install Uninterruptable Power System (UPS) as per documents and Drawings.

C. Provide and install power distribution as per documents and Drawings.

D. Install network management card(s) and verify connectivity to Owner's network.

1.02 QUALITY ASSURANCE

A. All equipment shall be installed in a neat and workmanlike manner.

B. All materials shall be installed per standard installation practices and manufacturer's specifications.

PART 2 - PRODUCTS

2.01 GENERAL

A. Quantities are to be as called out on Drawings.

B. All products must be new and UL Listed for their use.

2.02 UNINTERRUPTABLE POWER SYSTEMS

A. Units are Owner Furnished, Owner Installed, Contractor connected.

B. 2200VA UPS – Owner Approved are:

1. APC Smart-UPS RT 2200VA - Rack Mounted 120V, APC Part Number SURTA2200RMXL2U.

C. 3000VA UPS - Approved are:

1. APC Smart-UPS RT 3000VA - Rack Tower 120V, APC Part Number SURTA3000RMXL3U

C. 5000VA UPS – Approved are:

a APC Smart-UPS RT 5000VA RM 208V to 208/120V, APC Part Number SUA5000R5TXFMR.

b selected.

2.03. ENVIRONMENTAL MONITORING AND NETWORK INTERFACE MODULE

A. All UPS units will be equipped with a network management card with environmental monitoring. Approved are:

1. APC Part Number AP9631.

2.04 POWER DISTRIBUTION UNITS

A. One per rack in all Telecommunications Rooms. - Approved are:

1. Rack PDU, Server Technology C2WG08HC-0ABA2DAC.

PART 3 - EXECUTION

3.01 GENERAL

A. Follow manufacturer's instruction in terms of moving and mounting. These units will, likely, require two people to safely mount into the prescribed racks/cabinets.

B. Bond all TVSS components as per manufacturer's instruction.

C. Units are to be powered on and batteries fully charged prior to any load testing whatsoever` including the energizing of Owner supplied active electronics.

3.02 INSTALLATION

A. 2000/2200VA

1. UPS to be installed in lowest position of rack in the TR.
2. UPS to be installed in the lowest position of the wall mounted cabinets.
    a. The input for the UPS 120 Volt, 20 amps and requires a NEMA 5-20 receptacle.
3. Rack PDU – install one on each side on rear rails with supplied brackets in the rack allocated to Owner Supplied / Active Electronics. Energize from UPS.
4. Route network interface cable and output power cables in overhead ladder tray.
5. Network Management Card – install in each UPS. Connect to designated port on District supplied Ethernet switch. Verify link light on card.

B. 3000VA

1. UPS is to be placed in the bottom most position of the four-post rack in the Main Equipment Room.
    a. The input for the UPS 120 Volt, 30 amps and requires a NEMA L5-30 receptacle. This Contract is responsible for and must coordinate with Electrician for placement of this receptacle.
2. Rack PDU – install one on each side on rear rails with supplied brackets in the rack allocated to Owner Supplied / Active Electronics. Energize from UPS
3. Route network interface cable and output power cables in overhead ladder tray.
4. Network Management Card – install in each UPS. Connect to designated port on District supplied Ethernet switch. Verify link light on card.

C. 5000VA

1. UPS is to be placed in the bottom most position of the four-post rack in the Main Equipment Room (MDF) and the four-post rack in the IT Area.
    a. The input power for these units is 208/240 Volt. The APC comes with an 8 foot power cord and requires a NEMA L6-30R receptacle. The Liebert unit is designed to be hard wired. This contract is responsible for selection of the proper method of power to match the unit selected. This contact must coordinate with electrician for placement of receptacle or in the case of hard wire, coordinate the 208/240 Volt connection.
2. Rack PDU – spaced across the rear of the racks with supplied brackets in the rack(s) allocated to Owner Supplied / Active Electronics. Energize from UPS.
3. Route network interface cable and output power cables in overhead ladder tray.
4. Network Management Card – install in UPS. Connect to designated port on District supplied Ethernet switch. Verify link light on card.

END OF SECTION

SECTION 27 1313
COPPER BACKBONE CABLING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

1.02 SCOPE

A. This section includes the copper backbone cable and the termination requirements.

B. Multi-pair copper cables shall be installed between the Main Equipment Room (ER) and each Telecommunications Room (TR). Cables shall be terminated on 110 blocks in the ER and extended to rack mounted 24-port patch panels in each of the TRs.

1.03 QUALITY ASSURANCE

A. See Section 27 0513

B. All cable shall be installed in a neat and workmanlike manner.

PART 2 - PRODUCTS

2.01 UTILITY SUPPLY CABLE

A. The utility supply cable shall be six, category 6A, small diameter, plenum rated, 4-pair unshielded twisted pair cables.

B. The cable shall be 24 AWG with a jacket rated for installation in under-slab ducts.

2.02 PATCH PANEL

A. Utility Supply, 24 port panel, rated for small diameter Category 6A.

2.03 110 BLOCKS

A. 100 pair with legs utilizing C-5 clips

PART 3 - EXECUTION

3.01 GENERAL

A. Cable ties must be finger tight. The cable tie must not distort the outer jacket.

B. The bend radius shall be no less than 10 times the outside cable jacket.

C. Only Velcro-type wraps shall be used to bundle cables on the back of the equipment racks and in the cable trays located in the Telecommunication and Equipment Rooms.

3.02 PREPARATION

A. Conduits

1. All conduits and sleeves shall be inspected for bushings prior to cable installation. Missing bushings shall be brought to the attention of the Owner.

3.03 INSTALLATION

A. Copper Riser

Cable

1. Cables shall be installed between punch down blocks in the Main Equipment Room (MDF) and Telecommunications Rooms (IDFs).
2. The punch down side of the cable shall be terminated 110 blocks with C-5 clips. 110 blocks are to be placed on the telecommunications backboard in the main equipment room as per the drawings.

3. 24 port utility supply patch panels shall be placed as per the Drawings in each of the Telecommunications Rooms.
   a. Provide (1) in the MDF and (1) in each of the IDFs.
4. Place six cables from the 110 block in each room to the patch panel. Terminate all four pairs.

C. Label 110 blocks and patch panels “UTILITY FEED TO IDF-x”, where X = IDF Number, specifically “IDF-1”, “IDF-2” or “IDF-3”

END OF SECTION

SECTION 27 1323

COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

1.02 SCOPE

A. This section includes the fiber backbone cable and the termination requirements.

1.03 QUALITY ASSURANCE

A. See Section 27 0500

B. All cable shall be installed in a neat and workmanlike manner.

PART 2 - PRODUCTS

2.01 FIBER OPTIC CABLE

A. Singlemode fiber shall be 50/12mm Laser Optimized singlemode (OS2), low smoke, zero halogen (LSZH). Strand count shall be as per Drawings. Rating shall be suitable for applications with a minimum rating of OFNR. Factory terminated assemblies are preferred.

2.03 READER BOARD FIBER

A. This contract will place a six-strand singlemode fiber between the MDF and the Reader Board. Fiber will be placed using a two-cell Maxcell innerduct. A Trade Size 2 conduit will be installed by others as a pathway for the fiber and innerduct.

2.04 FIBER OPTIC TERMINATION

A. Fiber termination equipment will be:

1. 2U frame. Approved is Panduit part number FRME2U, or approved equal. Place one in each IDF. Two will be required in the MDF. One shall be used to land fiber from the IDF locations and the other shall be used to land the single mode fiber.
2. Single mode fiber shall terminate on UPC LC Fiber adapter panels. Approved is Panduit FAP12WBULCZ
3. Blank panels shall be used to cover all unused openings in the frames. Approved is Panduit part number FAPB.
4. Reader board fiber will be terminated as follows:
   a) Terminate fiber using duplex LC connector modules. Approved is Panduit part number CMDJAQLCZBL.
   b) Place fiber modules in surface mount box. Approved is Panduit UICBX4IW-A.

PART 3 - EXECUTION

3.01 GENERAL

A. Cable ties must be finger tight. The cable tie must not distort the outer jacket.

B. The bend radius shall be no less than 10 times the outside cable jacket.

C. Only Velcro®-type tie wraps shall be used to bundle cables on the back of the equipment racks and in the cable trays located in the Telecommunication and Equipment Rooms.

3.02 PREPARATION

A. Conduits - all conduits shall be inspected for bushings prior to cable installation.

3.03 INSTALLATION

A. Install per manufacturer's instructions.

B. Install the fiber optic cable by hand or by using a mechanical pulling machine. If a mechanical pulling machine is used, equip the machine with a monitored or recording tension meter. Ensure that at no time the manufacturer's recommended maximum pulling tension is exceeded. Ensure that the central strength member and aramid yarn are attached directly to the pulling eye during cable pulling. Use pulling attachments, such as
"basket grip" or "Chinese finger" type, to ensure that the optical and mechanical characteristics are not degraded during the fiber optic cable installation.

C. Ensure that excess cable is coiled in a figure eight and fed manually when pulling through
pull boxes and splice boxes by hand. If pulleys and sheaves will be used to mechanically pull through pull boxes and splice boxes, provide a drawing of the proposed layout showing that the cable will never be pulled through a radius less than the manufacturer's minimum bend radius. Use large diameter wheels, pulling sheaves, and cable guides to maintain the appropriate bend radius. Provide tension monitoring at all times during the pulling operation. Ensure that cable pulling lubricant used during installation is recommended by the optical fiber cable manufacturer.

D. Label fiber patch panels in the MDF as: "Feed to IDF-x", where x = IDF number

E. Label fiber patch panels in the IDF as "Feed from MDF"

F. Coordinate placement of fiber within the Reader Board with General Contractor.

G. Place Reader Board surface mount box on backboard in MDF. Provide a 20' slack coil of fiber. Label fiber and mounting box as "READER BOARD".

END OF SECTION

SECTION 27 1513
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all labor, materials, tools, and equipment required for the complete installation of work called for in the Contract Documents.

B. Install horizontal cable as outlined on drawings and specifications. Also included is sleeves for any ceiling or wall penetrations not provided by the General or Electrical Contractor; fire stopping as directed by the most stringent of these specifications or code; and all support structure needed to install the above components.

C. Verify actual counts on prints and drop detail.

1.02 SCOPE OF WORK

A. It is the intent of this section for the Contractor to provide a complete workable cabling system ready for the Owner's use in accordance with the latest current version of ANSI/TIA-568 standards to support high speed data applications up to 10Gbs including IEEE 802.3x system standards.

1.03 QUALITY ASSURANCE

A. All cable shall be installed in a neat and workmanlike manner.

B. Strictly adhere to all category 6A installation practices when installing horizontal cabling.

PART 2 - PRODUCTS

2.01 GENERAL

A. The horizontal UTP cabling system shall be a Category 6A, small diameter, plenum rated, warranted link system, including the patch cords, patch panels, cables, and telecommunications outlets.

2.02 COPPER CABLE

A. The horizontal copper cable supporting all locations except as noted on Drawings, shall be 4-Pair balanced twisted pair rated for category 6A, small diameter, plenum rated. Color to be blue.

B. Cable supporting locations identified as Wireless Access points (WAP) and so noted as a circled “W” on the Drawings, shall be 4-Pair balanced twisted pair rated for category 6A. Color to be yellow.

C. Cable called out as category 6A shall be 4-Pair balanced twisted pair, small diameter, plenum rated. Jacket shall be blue in color.

D. Backbone cable shall be 4-Pair balanced twisted pair rated for category 6A small diameter. Jacket shall be rated for wet locations and black in color.

E. Camera cables shall be Category 6A, small diameter, green in color.

PART 3 - EXECUTION

3.01 GENERAL

A. Cable ties must be finger tight. The cable tie must not distort the outer jacket.

B. The bend radius shall be no less than 4 times the outside cable jacket diameter for the horizontal UTP cable and 10 times the outside cable jacket diameter for both the fiber and multi-pair copper riser cable.

C. Only Velcro® (hook and loop) type cable wraps shall be used to bundle cables on the back of the equipment racks and in the cable trays located in the Telecommunication and Rooms.

3.02 PREPARATION

A. Conduits

1. All conduits and sleeves shall be inspected for bushings prior to cable installation.
2. Missing bushings shall be brought to the attention of the owner or authorized representative.

3.03 INSTALLATION

A. Copper Horizontal Cables

1. Installation shall be in a manner to meet the specifications as outlined by the cable manufacturer for the product set being installed.
2. Copper horizontal cables shall be pulled from the TR to the workstation.
3. Service loops of
   a. 10 feet minimum shall be left coiled high as high as possible in the MDF or IDF.
   b. 10 feet of slack shall be neatly coiled and secured with Velcro® at the telecommunications outlet (typically in the ceiling) used for Wireless Access points
   c. Placement of service loops subject to verification by Owner.
4. Location and label shall be annotated on the as built drawings.
5. Locations coiled for wireless shall have ½" black on white labels placed below the outlet on the ceiling grid.

END OF SECTION

SECTION 27 2000
VOICE AND DATA COMMUNICATIONS

PART 1 - GENERAL

1.01 SCOPE

A. Provide and install (1) CAT-6A cable from wireless access point locations to the Telecommunication Closet serving the area. Provide and install necessary cable pathways and conduits as shown on drawings.

B. Drawing depicts the general location of the access points. Include provisions for adjusting location up to 15 feet in either direction at no additional cost to Owner.

C. The Contractor shall provide all necessary project management, labor, materials, equipment, services, and other items required, whether specified or not, to furnish a complete and functional cabling installation. Among the items required are;
   1. CAT-6A cable, unshielded, twisted-pair and termination hardware.
   2. CAT-6A data patch panels in the MDF and IDF Rooms for terminating horizontal cable.
   3. Outlet devices and faceplates.
   4. Labeling in MDF Room, IDF Room(s), and at station locations.
   5. Installation, test data, and results.

D. Provide raceways for all wall locations and wireless outlets, run a 1-inch conduit from the cable tray (or nearest IDF Room) to a standard 4-inch square by 2.5-inch-deep electrical box with a single gang mud ring. Conduit should be sized for up to four data drops of spec'd cabling in wall for each location. For wall-mounted phone locations, run a 3/4-inch conduit from accessible ceiling space to a standard 2-inch by 4-inch by 2.5-inch electrical box with single gang mud ring. Refer to drawings and individual spec sections for additional details.

1.02 QUALITY ASSURANCE

A. Contractor Qualifications
   1. It is required that the Contractor shall have Systimax, Panduit, and Commscope certifications with not less than 50% of staffed technicians trained in Systimax structured cable systems. Contractor must supply documentation as proof that this requirement is met prior to award.
   2. Work in this section shall be performed by a low-voltage Contractor with demonstrated experience in the installation of inside and outside plant cabling.
   3. The Contractor shall have demonstrated experience in the installation and testing of all cable plant components specified herein.
   4. The Contractor shall have installed cable plant in buildings similar in size and scope to this project.

1.03 WARRANTY

1. Guarantee all work against faulty and improper material and workmanship for a minimum period of one (1) year from the date of final written acceptance by the 4J School District, except where guarantee or warranties for longer terms are specified herein.
2. Contractor is to provide a 20+ year manufacturer extended warranty for the work performed on this project.
3. Upon notification of a problem, the warranty provider shall furnish within 48 hours and at no cost to the 4J School District, such labor and materials as are needed to restore the system to proper operation.

1.04 REGULATORY REQUIREMENT

A. All work shall be performed in accordance with the latest revisions of all national and local governing codes and standards, including:

Uniform Building Code	State of Oregon Edition (UBC)
NEC	National Electrical Code
NFPA 75	Protection of Electronic Computer and Data Processing Equipment
NFPA 78	Lightning Protection Code
NFPA 101	Life Safety Code
FCC Part 68	Connection of Terminal Equipment to Telephone Network
ANSI/TIA/EIA	American Standards Institute/Telecommunications Industry Association/Electronic Industries Alliance

PART 2 - PRODUCTS

2.01 INTRODUCTION

A. All materials constituting the data, facility shall conform to the specifications herein.

B. All products shall be new and shall be brought to the job site in original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All communications cable shall bear the manufacturer's label in accordance with NEC 800 based on flammability testing as follows:
   1. CMP Plenum-rated Communications Cable

2.02 PRE-APPROVED PRODUCTS

A. The following product sets only are approved for this project.
   1. Racks, cabinets, enclosures, frames and associated fastening devices: Chatsworth Products Incorporated (CPI)

2.02 TELECOMMUNICATIONS RACK

A. Freestanding telecommunications racks shall be installed in the Telecommunications Rooms.

B. Racks shall be Chatsworth 7' x 19". Part 55053-703

C. Chatsworth 3" channel rack-to-runway mounting plate with bracket. Part 12730-712

D. Chatsworth cable runway radius drop, Part 12100-712

2.03 TELECOMMUNICATIONS RACK – FOUR POST

A. Four-post server racks shall be installed in the Telecommunications Equipment Rooms.

B. Racks shall be Chatsworth 7' x 19" x 40" (D), Part 15214-703

C. Chatsworth Runway Mounting Bracket, Part 15205-701

D. Chatsworth Equipment Support Rails, Part 15235-706

2.04 LABELING

A. Telecommunications Racks and Frames

1. Labeling in the Main Equipment Room and Telecommunications Rooms shall be as per the Drawings. Labels shall be 1" black laminate with ½ inch white letters. Labels shall be placed left-to-right identifying "FRAME-1" through "FRAME-x", where "x" = number of racks/cabinets present.

2.02 CHANNEL RACK-TO-RUNWAY

A. Use a Channel Rack-to-Runway Mounting Plate Kit to securely attach 12" wide cable tray to equipment rack. A kit from Chatsworth includes all necessary bolts, washers, and nuts to make the attachments. CPI Part 12730-712

2.03 HORIZONTAL WIRE MANAGEMENT

A. Horizontal cabling managers shall be used to organize and contain patch cord runs from patch port to vertical cable wire management. Manufacturer to be same as structured cabling system.

B. Double (3.5') RMU units only are acceptable and are to be supplied at the rate of 1 RMU per each 48 ports of patch panel.

2.04 VERTICAL CABLE MANAGEMENT

A. Vertical cable managers shall be installed as per Drawings. CPI 11729-703

2.05 EQUIPMENT SHELF

A. Provide equipment shelf, CPI 40074-700 at the rate of one per rack. Deliver in unopened carton to Owner.

2.06 HORIZONTAL CABLE

A. The following paragraphs describe the cabling for data wireless station outlets.
   1. One (2) 24AWG, 4-pair, shielded, twisted-pair cable at each location unless specified otherwise noted on the drawings.
   2. For Wireless CAT 6A: CMP rated: Systimax 2061 White, Material ID: 106946825, or approved equal.

2.07 WORKSTATION OUTLET DEVICE

A. The termination jack for the standard connections shall be an 8-pin (4 pair) modular jack T568B rated for category 6A. Jacks shall be different colors and installed as follows:
   a. Upper left – black
   b. Upper right – gray
   c. Lower left – gray
   d. Lower left - blank

B. At the outlet location, approximately 6-9 inches of slack cable shall remain to facilitate servicing after the installation.
C. Termination for cables supporting WAPs is to be made using a white category jack. Each WAP location shall be one cable placed in a white, two port biscuit box.
D. Termination for cables supporting WAPs shall provide a 20 foot slack loop to be coiled and secured with Velcro®. Biscuit box shall be affixed to structure.

2.08 STANDARD OUTLET BOX

A. If possible, every effort is to be made to conceal cabling inside walls with a single-gang cut-out. Product: Enrico Material ID: MP-1

B. The standard outlet box is a 5.0-inch by 3.3-inch by 1.6-inch surface-mounted electrical outlet box. Product: Panduit 2-piece Low Voltage Surface Mount Outlet Box, Off White, Material ID: JB3510IW-A

2.09 TELECOMMUNICATIONS OUTLET FACEPLATE

A. The standard Telecommunications Outlet faceplate consists of Product: Systimax M10L-246, or approved equal, 1-Port Faceplate, Gray Material.

B. The faceplate will house the termination for a Category 6A 4-Pair UTP cable for data. Product: Systimax MPS100E-270 Cat 6A, RJ-45 Insert, or approved equal, appropriate color for corresponding faceplate.

2.10 DATA CABLING MDF and IDF PATCH PANELS

A. For Cat 6A, small diameter cable - Panduit Pan-Net, .230 diameter; Products: Systimax, Model 1100PSCAT6A [24-port], Material ID:10808919 or Systimax, Model 1100PSCAT6A [48-port], Material ID:108208935, or approved equal.

2.11 PUNCHDOWN BLOCKS

A. 100 pair 110 type punch down blocks with legs.

B. 4 pair connecting clips (C4 clips)

2.12 PATCH PANELS

A. 8-pin modular Category 6A 24 or 48 port for access control applications.

B. 8-pin modular Category 6A (Copper Risers) 24 or 48 port for voice and utility applications.

C. 8-pin modular Category 6A (Station Cables) 24 or 48 port for data cabling.

2.13 ASSOCIATED PRODUCTS

A. Fire stopping
   1. Products: T&B Flame Safe Compound, 3M Fire Barrier Caulk

PART 3- PRACTICES

3.01 PRODUCT INSPECTIONS

A. All products shall be inspected prior to installation to verify that they are of proper gauge, contains the correct number of pairs, and otherwise meets specifications. Any physical damage to products is unacceptable. Uniform jacket thickness, tightness, or buckling should be checked. All outlet devices, cross-connect blocks, and other components shall also be inspected prior to installation.

3.02 SERVICE INTERRUPTION

A. The Contractor shall prevent interruption of service by identifying and providing temporary supports and protection of existing communications cables, cross-connect blocks, and equipment throughout demolition and construction. In the event existing active communications cabling, outside the scope of the project, needs to be relocated, the Contractor shall immediately notify CIS.

B. If accidental interruptions do occur, the Contractor shall immediately notify CIS coordinator so that service may be re-established as soon as possible.

3.03 CABLE INSTALLATION

A. General
   1. The Contractor shall ensure that communications cable is installed with care, using technique which prevent kinking, sharp bends, scraping, cutting, or deforming the jacket, or other damage. Installation shall be subject to periodic inspections by 4J School District. The Contractor shall replace unacceptable cable at no additional expense to the District.

B. Routing
   1. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purpose (e.g., access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures).
   2. The installation of cable around movable devices, instruments, sub-panels, etc., shall be provided with adequate support, length, protection, and flexibility so that the cable is not damaged in the event the equipment is moved.

C. Pull Lines
   1. A 3/32-inch diameter, 200-pound strength polyethylene pull line shall be installed in all communication system conduit, both empty and with cable. This provides a pull line available for the next cable installation. Each end of the pull line shall be secured.

D. Cable Bend Radius and Pull Tension
   1. Communications cable cannot tolerate sharp bends or excessive pull tension during installation. Contractor shall observe manufacturer's recommended bend radius and pull tension for all cable.

E. Cable Lubricants
   1. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces shall be cleaned free of lubricant residue.

F. Cable Support
   1. All cable shall be supported every 4 feet vertically and horizontally. Backbone cables shall be supported at each penetration. Cables shall be organized neatly, by system (voice/data/catv, etc.), and separately supported "D-rings" shall be used to support cable vertically and horizontally by means of D-rings screwed to the outside edge(s) of the backboard. Installation of these supports shall be done with care, so as not to cause crushing or distortion of the cable or result in tighter radius bends than the minimum radius permitted for each type of cable. Cable not dressed in a neat fashion of installed with excessive slack shall be rejected.

G. Penetrations
   1. Not less than a ¾-in EMT conduit shall be used when penetrating inside walls from corridor to classrooms. Conduits shall be reamed and free of burrs and have bushings installed at both ends before cable is pulled.
   2. Not less than a 2-in EMT conduit shall be used when penetrating walls to the MDF and IDF Rooms or outside pathways. Conduits shall be reamed and free of burrs and have bushings installed at both ends before cable is pulled.

H. Cable Removal
   1. All communications cable that has been decommissioned, slated for demolition or otherwise found abandon, shall be removed from ceiling spaces, conduit, cable tray, and other raceway

3.04 GENERAL REQUIREMENTS – RACKS

A. Racks shall be firmly affixed to the floor using anchors and Grade 5 bolts.

B. Top of rack shall be firmly affixed to ladder tray by means of a mounting plate as detailed in Section 27 1123.

C. Rack shall be bonded to adjacent assemblies as detailed in Section 27 0526.

D. All metallic components shall be bonded as per 27 0526.

E. A two RMU horizontal wire management panel shall be installed at the top of the rack. Additional horizontal wire management shall be installed as described above.

3.05 CONDUIT USAGE and FILL

A. Dedicated Use
   1. Communications cable shall not share conduit with electrical power wiring, fire alarm or intercom system wiring, or any other building system.

B. Fill
   1. Communications conduit shall not be filled beyond 40% capacity. Refer to NEC for conduit capacity for various trade sizes of conduit.

C. Cable Lubricants
   1. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces shall be cleaned free of lubricant residue.

3.06 CABLE TRAY USAGE and FILL

A. General
   1. Contractor shall not attach any devices, raceway, or other building systems to sides or bottom of cable tray without prior approval from 4J School District.

B. Fill
   1. Communications cable shall be installed in cable tray as indicated in the Contract Documents. Cable tray fill shall not exceed 40% of total tray cross-sectional area per NEC.

C. Transitions
   1. Install cable so that entry to and exit from tray is supported by drop-out plates or other listed devices installed to ensure cable is not stressed at the point at which it enters or exits the tray. Where the cable bundle makes the transition from conduit to cable tray, the cables shall drop, as much as possible, perpendicular to the tray. (They shall not slope to a point more than one foot along the tray.

D. Dressing
   1. Wherever cable tray is exposed in hallways, whether completely visible or partially concealed, extra care shall be taken to neatly dress all cable between the conduit and the tray. Do not secure cable in bundles while inside the tray. Cable shall remain loose, not bound, but neatly managed in tray. In the MDF and IDF cables will be bundled using Velcro only.

E. Fire-Stopping

1. During the final review and inspection period, following the 4J School District inspection of cable installed and tested acceptable, but prior to substantial completion, all sleeves passing through floors, roofs, and exterior walls shall be filled with approved fire-stop material in accordance with NEC 300-21. All firewall penetrations shall likewise be filled with suitable fire-stop material. Unused sleeves shall be capped or grouted.
2. In situations where cable tray, conduit, or sleeves extend outside the construction area into occupied portions of the building, they shall be capped or fire-stopped throughout the course of construction.

3. The ancillary space around all sleeves passing through fire-rated construction shall be sealed with approved fire-stop material in accordance with NEC 300-21. Unused sleeves shall be sealed with approved fire-stop material. UL listed fire-rated conduit caps may be used to seal unused sleeves and conduit except where conduits have grounding bushings.
4. In situations where cable tray, conduit, or sleeves extend outside the construction area through fire-rated construction, they shall be capped or sealed throughout the course of construction.
5. Where conduits extend through walls to the exterior of buildings, conduits shall be sealed with weatherproof material or capped. Unused conduits in outside cable plant pull vaults or duct banks shall be capped.

3.07 TERMINATIONS

A. 110 blocks shall be labeled as per criteria provided on Drawings and Section 27 0553

B. A one RMU horizontal wire management panel shall be installed at the top of each rack used for copper backbone cables. Additional horizontal wire management shall be installed at a rate of one RMU per each 48 port panel installed.

3.08 HORIZONTAL CABLE PLANT

A. Cable Installation and Routing
   1. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purpose (e.g., access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures).

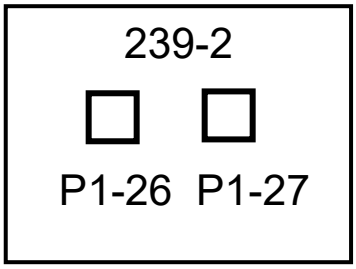
B. Cable Terminations
   1. Unless noted otherwise, termination hardware shall be grouped in rows and columns. No termination hardware shall be located closer than 12 inches from a corner. The top edge of the termination hardware shall be 62 inches above the finished floor. The termination hardware shall be grouped by application (i.e. voice and data), and arranged with from left to right, top to bottom. Adequate space shall be provided adjacent to voice and data termination hardware to allow for future growth. Termination hardware space is allocated for each cabled communication outlet.
   2. Data station cable shall be terminated left to right on a patch panel.

C. Cable Identification
   1. All station cables shall be labeled. Labels shall be typed in a permanent and legible fashion and securely attached. Cable shall be labeled in the MDF/IDF Rooms on the termination hardware at both ends. The Contractor shall securely affix labels to both ends of each cable identifying the cable.

D. Horizontal Cable Termination in MDF/IDF Labeling
   1. Each Patch Panel jack is identified by a unique number. The basic methodology for the jack's identification is as follows:

Room number	237
IDF number	2
Patch Panel	P1
Jack Type (V=voice/D=Data)Sequence number	P1-D22

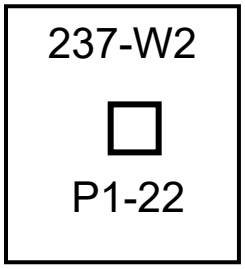
Data Patch Panel Example



E. Horizontal Cable Termination at Workstation
   1. All faceplate identification shall be consistent with the numbers on the Telecommunication Outlet Schedule included in the Attachment. Document grid numbers are unacceptable. 4J School District-assigned room numbers shall be used.
   2. All plastic faceplates shall have a typed label securely attached to the faceplate indicating that location's ID number

F. Labeling
   1. All faceplates shall be labeled. The typed labels shall be legible, permanent and securely attached to the respective faceplate. Position the room and the IDF number centered at the top of the faceplate and the outlet number at the bottom of each outlet.

Example:



3.09 TESTING

A. General
   1. Acceptance of the simple test procedures discussed below is predicated on the Contractor's use of the recommended products (including, but not limited to, twisted-pair, fiber and coaxial cable, and outlet devices specified in the Products paragraph), and adherence to the inspection requirements and practices set forth.
   2. At a minimum, the Contractor shall test:

3. All horizontal cable from MDF/IDF termination points to outlet device.

B. Horizontal Cable Testing
   1. All testing shall be done using the permanent link parameters.
   2. All pairs shall test "pass" and meet appropriate performance parameters. Open, split, mis-terminated pairs, deviations from the manufacturer's installation specifications, defective connections and bad installation practices shall not be accepted and shall be corrected. Test 100% of all station cable.
   3. Test results shall meet or exceed the performance test requirements as specified in the current ANSI/TIA/EIA specifications.
   4. Provide complete documentation of all tests. Documentation shall include outlet number, and results of performance testing done with the cable analyzer. Analyzer documentation of testing shall consist of test result recorded in a ".txt" or ".csv" file on USB storage drive or archived on to a CD-ROM. Test results shall be submitted and approved prior to substantial completion and final payment approval.
   5. The Contractor shall undertake post-installation testing of all copper cabling. Fluke DSP-1800 certification and summary (or an approved equivalent) must be provided for all Category 6A.
   6. All cable paths will be tested at each jack according to TIA/EIA-568-B.2 for the following parameters:

      Wire Map
      Insertion Loss
      Cable Length
      NEXT Loss Pair-to-Pair
      NEXT Loss Power Sum
      ELFEXT Pair-to-Pair
      ELFEXT Power Sum
      Return Loss
      Propagation Delay
      Delay Skew
      Loop Resistance
      Impulse Noise
      Cable Length and Impedance (characterized by onboard Time Domain Reflectometer)
      Cable attenuation
      Cable near-end crosstalk

   7. All test results observed according to the above-listed criteria will be printed on hard-copy and captured on computer disk file and the results (for line mapping, loop resistance, and impulse noise) will be used by the Contractor to determine any polarity and noise anomalies for immediate correction.
   8. Test results for cable impedance, length, NEXT, will also be printed on hard-copy, or captured on computer disk file. These results will be used jointly by the Contractor and 4J to determine the viability of each sheath for midspeed LAN transmission in accordance with the specifications of the cable manufacturer, and the requirements imposed by the EIA-568 building wiring specification. This will form part of the acceptance procedure for the copper cable plant.
   9. All hard-copy results obtained by use of pair-scanner testing will be collated by building and Telecommunications Outlet number, bound, and presented to the Architect at the conclusion of the testing for each building. Each individual test compilation for each building shall be initialed and dated by the Contractor's technician performing the test. The format of each test will be as shown in the Appendices – Horizontal Twisted Pair Test Results.

C. Defects

1. When errors are found, the source of each error shall be determined and corrected and the cable retested.
2. All defective components shall be replaced and retested following the procedure described above.

3. A list shall be submitted for District approval of any defective components that the Contractor is unable to correct with a detailed explanation and alternative proposals.

D. Test Records
   1. Test records for cable shall be maintained using an organized format. The forms for twisted-pair and optical fiber cable shall record MDF/IDF Room number, backbone pair/strand number or outlet ID, outcome of test, re-test results after problem resolution, and signature of the technician completing the tests. Test results shall be submitted in electronic format. Sample forms are included in the Appendices of this document.

END OF SECTION

SECTION 27 5113

INTERCOMMUNICATION (INTERCOM) SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

A. Furnish and install complete and operating addition to the existing system.

1.02 DESCRIPTION OF SYSTEM

A. System provides ALL CALL and zone paging throughout the building, operated by picking up a telephone with this class of service and dialing an access code.

B. When not being used for paging, system serves as a distribution system for background music.

1.02 QUALITY CONTROL

A. Extron integrated AV system equipment shall be accepted for both paging and wireless master clock systems as a complete package. Refer to 27 5116.

PART 2 PRODUCTS

2.01 FLUSH SPEAKER, STANDARD

A. Backbox: Shallow.

B. Speaker:

1. 6.5-inch, 16 watts normal power rating.
2. Full frequency response for paging.

C. Baffle:

1. Round, flat, heavy gauge steel.
2. Finish: White enamel.

D. Extron CS3T.

2.02 FLUSH SPEAKER, HIGH CEILING

A. Backbox: Shallow.

B. Speaker:

1. 6.5-inch, 65 watts normal power rating.
2. Full frequency response for paging.

C. Baffle:

1. Round, flat, heavy gauge steel.
2. Finish: White enamel.

D. Extron SF26T.

2.03 VOLUME CONTROL

A. Priority attenuator type, stainless steel wall plate for single-gang outlet.

B. Outlet:

1. Box: 4-inch square, 1-1/2 inch deep, single-gang plater ring, flush in wall.
2. Conduit: 1/2-inch EMT to accessible ceiling.
3. Volume controls located at speaker, in ceiling space, require only a box.

2.04 PAGING AMPLIFIERS

A. 70V, convection cooled, rack mount.

C. Extron MPS 601-70V, XPA 2001-70V, XPA U 358-70V depending on application. Verify exact model number with manufacturer.

2.05 WIRING

A. No. 22 AWG, solid, color coded pairs, plenum rated, overall PVC jacket.

B. Mohawk #1403 (3-pair) or Equal:

1. One Pair: To volume and speaker.
2. One Pair: To volume and speaker.
3. One Pair: Spare.

PART 3 EXECUTION

3.01 INSTALLATION

A. Rough-In and Wiring Pulling: Requirements shall be coordinated with installer.

B. Equipment Installation: Shall be made by trained manufacturer's representative.

C. Fastening and Support:

1. All equipment, except portable equipment shall be held firmly in place including loudspeakers, amplifiers and cable.
2. Adequate to support their loads with a safety factor of at least three (3).

3.02 WIRING

A. Provide wiring as required by manufacturer for number of stations and arrangement shown.

B. Circuits, home runs, and feeders shown on Drawings are to establish routing and general system connection only. Provide number and type of wires as recommended by manufacturer.

3.03 PROVIDE THE FOLLOWING MINIMUM ZONING

A. Each Classroom, Office, and Conference/Work Room shall be capable of being zoned individually.

B. Building Exterior and playground.

C. 1st Floor Hallways and Common areas.

D. Main Gymnasium.

K. Office / Admin area.

L. 1st Floor Classrooms

M. 2nd Floor Hallways and Common areas.

P. Library.

Q. 2nd Floor Classrooms.

R. Custodial / Equipment / Service areas.

3.04 TESTING AND ADJUSTMENT

A. Test each circuit after installation for quality of operation.

B. Set speaker transformer taps for proper sound volume, assuming a normal room ambient noise level.

END OF SECTION

SECTION 27 5116
INTEGRATED AUDIO-VIDEO SYSTEMS

1 PART 1- GENERAL

1.1 PROJECT SCOPE

A. This section covers the requirements for a Contractor to design, provide equipment for, and install instructional classroom technology. This is intended to supply a complete instructional technology classroom that can be arranged in multiple configurations. There will be a multimedia display as primary projection. Flexibility, integration of multiple technologies and sources, and multiple user groupings are essential to this concept. As an example, any audio and image sources should be capable of being shown on the screen and heard in the classroom. The work covered in this document consists of furnishing all labor, material and services necessary to install a complete audiovisual system as indicated on the project drawings and in these specifications.

B. Deliverables: Prior to ordering materials or commencing any construction activities, the Contractor shall provide the Owner with a complete bill of materials, including all quantities of components, devices, equipment, and wiring required to complete this work. Submit product data, including manufacturer's data sheets for all proposed system components. Submit three copies with all specific items that will be provided clearly indicated and any options highlighted.

1.2 ACCEPTABLE MANUFACTURERS - SYSTEMS

A. Manufacturer

Extron Electronics
Contact: Joe Sanders
(714) 491-1500 ex. 6160
jsanders@extron.com

B. Substitutions: Must be approved in writing and in full compliance to specifications as written.

C. All equipment part numbers shall be listed in the bill of materials and the system drawings specifications.

1.3 SUBMITTALS

A. Shop Drawings

1. A complete and comprehensive list of materials with quantity, manufacturer, model and part number and reference to the Part 2 specification paragraph number for each item.
2. Manufacturers Data Sheets of all products and cabling, specific to the project.

Data sheets shall show the exact parts, with model numbers and options as required and clearly identified.

a) Drawings shall include designations, dimensions, operating controls, electrical requirements, input/outlet configurations, operating controls, etc.

b) Major components including all sub-assembly components (daughter cards, option cards, etc.) required to perform the specified functions.

c) Any items of equipment which have features and/or functions that deviate from the specifications contained herein shall have these

deviations clearly called out by a separate attachment with the shop drawings specifically listing and detailing the deviation along with a justification. Deviations must be approved specifically in writing.

G. Job specific diagrams

1. This indicates a block schematic diagram that shows all major items of equipment required for the contract project and the actual interconnection that will be installed.

2. Riser diagram showing conduit requirements with pull boxes, outlet boxes, part numbers of cable used, and a number of circuits in each conduit. 3. Electrical power requirements for the head-end and ancillary equipment. Include diagrams for any remote control of electrical power, in sufficient detail to coordinate with electrical work. Electrical diagrams shall also indicate all required plug and power outlet configurations including where direct connection is required/preferred.

4. Schematic and point-to-point wiring diagrams showing all devices and wiring.

5. Identify terminals to facilitate installation, operation, and maintenance.

6. Single-line diagram showing interconnection of components.

7. Cabling diagram showing cable routing.

8. Details of interconnection with other systems

9. Supplier shall provide rack elevations showing the configuration of all rack mounted equipment including detailed interconnection diagrams between equipment

10. 30x42 floor plans at a scale of not less than 1/8"=1'-0" showing the location of all items of equipment. Drawings shall also indicate each location where electrical power is required, and the specific configuration of that power connection (voltage, plug type. mounting height, etc.)

11. Proposed construction details for all custom fabricated items, including wall plates, interface panels, mounting hardware and systems, and rigging hardware. These details shall show labeling, dimensions and indicate finishes and color selection.

12. Power calculations for sizing Owner Furnished Contractor Installed UPS system.

2 PART 2 - PRODUCTS

2.1 SYSTEMS DESCRIPTION

A. Provide a complete Audiovisual System for small to medium sized classrooms. The system switching and audio amplification equipment shall be securely mounted and concealed in an enclosure mounted in close proximity to the display device. Audio and image source equipment can be connected to the system and displayed via active (powered) interface panels located throughout the room. The audio and image signals from source devices shall be transmitted from the active interface panels over plenum rated, Cat6 shielded twisted pair cabling architecture.

B. Classroom Definition: A classroom that has fixed instructional media video projection capabilities, Internet connectivity at the teacher's station, student networking (usually wireless), a document camera, and/or other multimedia input devices, current laptop interface, multimedia control system that is connected to the network and capabilities for additional add-on modular features.

Technology Enhanced Classrooms (TECs) use standardized control/interface systems and employ a standardized operational protocol. The principles of this recommendation are to establish desirable goals with respect to classroom design and installed technology. The TEC classroom standard includes control systems that have ADA, Section 508 compliant buttons

that are discernible without activating the controls or buttons on the control panel, easily reached control panel locations. The system will also support ADA Section 504 closed captioning and hearing assistance capability. These features combined with a user friendly operator protocols are among the features sets that are consistent with universal design principles.

All new construction general purpose classrooms will meet this minimum standard. The standard will be met in major renovations wherever possible. The standard will be retrofitted in existing general purpose classrooms according to an established upgrade plan.

C. Gym / Cafeteria: Provide a complete video/audio presentation system in each space. System shall include video content, voice and audio reinforcement, and assistive listening facilities.

2.2 GENERAL EQUIPMENT REQUIREMENTS

A. Eacj room will be equipped with a standard easy to operate interface (a tactile button keypad layout). The audio system may be monaural or stereo for program sound. The instructional media system will be controlled by a control system with a control panel mounted near the instructor area. System parameters can be monitored, administered and controlled over the data network. The instructional media equipment will be located within close proximity to the instructor area or through a Graphical User Interface (GUI) on a computer to allow for ease of operation during instruction.

Acceptable functionality requirements are listed below categorized by type of equipment. Quantities are listed for movable, portable or loose equipment, and other selected entries. Where quantities are not listed, refer to the system drawings.

B. The System components shall all be correctly listed and labeled by Underwriters Laboratories Incorporated (UL) for their intended use.

C. All products shall be new and under warranty at the time of installation. B-stock, previously installed, refurbished or used equipment shall not be provided on this project.

D. Where the specification lists several manufacturers for a major item, or group of items, the AV Contractor shall provide that entire item from one manufacturer only.

E. The Contractor shall provide all options, accessories and hardware necessary to meet the function of the design even if they are not specifically listed (i.e. mounting kits, separate or additional power supplies, input modules, transformers, cabling etc.).

F. The equipment shown on the Contract Drawings is to indicate the minimum system required, but may not show all of the required components or wiring. It is the responsibility of the Contractor to provide a complete integrated audio-video and communications system as needed to meet all applicable requirements under this section

2.3 FIXED EQUIPMENT

A. CLASSROOMS

Provide the following Audio Video System as an all-inclusive system as described below, one system for each room as indicated on Drawings:

1. Mounting - The audio, video, data connectivity components and projector or display, if applicable, shall be mounted using the following components depending on the instructional space design requirements.

a. Drop ceiling projector mounting

(1) Projector Drop Ceiling Mount with Adjustable Pole

The Drop Ceiling Mount shall include an integrated pole that provides up to 21.5” of vertical adjustment to accommodate various projector height requirements. One end of the pole will be finished with 1.5” NPT (National Pipe Thread Taper) for mating with the Universal Projector Bracket.

Check the structural ceiling to ensure that it can support a load four times the weight of the final setup. Check that the ceiling plate to be used is suitable for the angle of the ceiling where the projector is to be installed. Refer to local building standards and codes to verify that the installation meets all the relevant regulatory standards. The projector drop ceiling mount must be capable of mounting to the structural ceiling (concrete or wood joists), above the suspended T-Bar ceiling, incorporating 2' x 2' or 2' x 4' ceiling tiles, via turnbuckles and tie wire or threaded rod.

The mount shall be capable of supporting up to 50 pounds of A/V equipment.

The mount must also include (1) single gang and (1) double gang knockout openings for junction boxes or for use as cable pass-throughs.

b. Multi-Product Mounting Kit

(1) The pole mounted multi-product mounting kit houses the key electronic components of the AV system including the switcher, audio amplifier and power supply. The kit shall mount directly to the projector pole and protect the contained components from tampering and theft.

(2) For locations that have wall mounted projectors or flat panel displays (ALTERNATE 2)

The PVM 220 PlenumVault Mounting Kit is a secure, fully enclosed housing for storing PoleVault® AV system components in the plenum space above a suspended ceiling. The 2’ x 2’ enclosure provides ample space for mounting a variety of devices and offers four integrated AC outlets. The integrated fan air management features allow room side air to keep components cool and extend their operating life. The hinged door provides access for setup and maintenance tasks. To maintain room aesthetics, the PVM 220 accepts a trimmed ceiling tile to blend in with the rest of the ceiling.

Check the structural ceiling to ensure that it can support a load four times the weight of the final setup. Refer to local building standards and codes to verify that the installation meets all the relevant regulatory standards. The PlenumVault mounting kit must be capable of mounting to the structural ceiling (concrete or wood joists), above the suspended T-Bar ceiling, incorporating 2' x 2' or 2' x 4' ceiling tiles, via turnbuckles and tie wire or threaded rod.

(3) For locations that have wall mounted projectors or flat panel displays

The WMK 160 PoleVault Digital Wall Mount Kit is a fully enclosed, vented housing for wall-mounting the electronic components of a classroom AV system. The WMK 160 allows PoleVault Digital Classroom AV system equipment to be mounted on a wall in close proximity to the display, making it ideal for installations with a flat panel display or wall-mounted, short throw projector. The WMK 160 is available in a white painted finish.

(4) Universal Projector Bracket

For locations that have ceiling mounted projectors - The UPB125 Series Ceiling mount is a recommended for mounting a projector in locations with open ceiling space. The UPB series is available in black, can support a projector setup weighing up to 500 lbs (226.8 kg), and is suitable for installation on wooden joists and metal beams. It has an integral 1.5" NPT adapter, allowing the attachment of a suitable projector pole, such as one of the Extron PMP (Projector Mounting Pole) series. The projector bracket must have independent adjustments of horizontal tilt or roll (± 4 degrees of horizontal tilt), vertical angle or pitch (± 25 degrees of vertical angle), and rotation or yaw (360 degrees of rotation).

The projector bracket shall also use a 1.5" NPT threaded pipe adapter for mounting a projector pole. The projector bracket should also maintain positioning adjustments even if the projector is removed for service. The bracket should also feature security flanges that enable the entire unit to be locked to prevent theft.

2. System source selection and switching and amplification shall be provided by a PVS 407D Switcher.

(1) The switcher shall have two (2) inputs that each support connection to a dual input switching wallplate via one (1) female RJ-45 connector.

(2) Audio for switched video sources shall be carried on the same RJ-45 connections.

(3) The switcher shall have a switched auxiliary audio input to support audio from video sources that are directly connected to the display or sources that only offer audio content.

(4) The switcher shall have two HDMI auxiliary inputs and one HDMI video output

(5) Connection from the switcher to the display device shall be provided with one HDMI to HDMI video cable.

(6) An onboard audio amplifier shall provide gain / volume adjustment from -10db to +10db, adjustable in 1 db steps. The speaker amplifier shall have two (2) channels, one (1) stereo (default) or dual (2) mono channels via one (1) 5.0 mm 4 pole captive screw connector. The output of the amplifier shall be 25 watts (rms) per channel at 4/8 ohms.

(7) In addition to the stereo / mono speaker output, an additional audio output that will produce line level output shall also be available. This line level audio output must be capable for being set at either "fixed" or "variable" and with Balanced or Unbalanced settings.

3. Media Source Control:

a. Classroom media sources shall be controlled with a MediaLink Controller.

(1) The MediaLink Controller (MLC Plus 200) shall contain ten tri-color, multi-status LEDs push-buttons for source device selection and display on/off control. A rotary volume control knob with five (5) LED volume indicators shall permit system volume level control.

(2) The MLC Controller shall feature Extron IP Link Ethernet for monitoring, scheduling and control. This IP technology shall enable the device to be controlled, scheduled and monitored over a LAN, WAN or the Internet using Extron Global Viewer or MLC controller software.

(3) The Controller shall contain a serial host port which shall consist of one (1) bi-directional RS-232 front panel 2.5mm mini stereo jack. This host connection port shall be for configuration and control of the controller itself and to install device drivers for the equipment to be controlled.

(4) The Controller shall also feature (2) bi-directional serial ports to provide device control. These two ports shall control the display device and PVS AV Switcher respectively via bi-directional RS-232 control via one (1) 3.5mm direct insertion captive screw connector.

(5) The MLC Controller shall also have two (2) configurable (via software) digital input / outputs for devices such as sensors, switches, LEDs and relays via one (1) 3.5mm 4-pole direct insertion captive screw connector.

(6) Connection from the MLC Controller to the display shall be provided by one (1) 50’ display control cable.

(7) Connection from the MLC Controller to the PVS AV Switcher shall be provided by one (1) 50’ switcher control cable.

4. Audio & Speech Reinforcement:

a. Speakers - In suspended ceiling applications, one (1) pair of Extron FF120 speakers are used for spaces up to 1000 sq ft. Provide quantities and locations as indicated on Drawings

(1) These speakers feature a low profile, 3.25” deep, aluminized composite enclosure, rectangular shape with a metal grille.

(2) The coverage angle of the speaker offers an extraordinarily wide dispersion area of 170 degrees, providing a very wide room coverage pattern.

(3) Meeting the regulatory compliance safety specifications of NFPA 90A, NFPA70; UL Listed for use in plenum airspaces: meets UL 2043 for heat and smoke release, meets UL 1480 for commercial and professional audio

(4) The speakers feature a frequency response of 68 Hz to 18 kHz – 10 db, half space.

(5) The power capacity is 16 watts of continuous pink noise or 32 watts of continuous program media.

(6) The nominal impedance is 8 ohms.

(7) The input connector uses (1) 5mm captive screw for 1 input

(8) Connection from the PVS AV switcher to the FF120 speaker is provided by Plenum rated 18 Gauge Speaker Cable Extron SPK-18.

b. Speakers – In surface mount applications, one (1) pair of Extron SM 3 speakers are used

(1) The speakers feature a 3” full-range driver and a high impact enclosure

(2) The speakers include an exclusive mounting system allows the speaker to slide onto the mount, lock into place, and auto automatically mate with the pre-wired contacts.

(3) The speakers feature a frequency response of 75 Hz to 18 kHz

(4) The power capacity is 15 watts of continuous pink noise or 30 watts of continuous program media.

(5) The nominal impedance is 8 ohms

(6) Connection from the PVS AV switcher to the SM 3 speaker is provided by 18 Gauge Speaker Cable Extron SPK 18.

c. VoiceLift Wireless RF Microphone:

(1) VoiceLift Pendant Microphone:

(2) The wireless pendant microphone is lightweight and designed to be worn around the neck with a lanyard or clipped on the belt or lapel. The instructor’s voice is picked up by the microphone and transmitted wirelessly to a receiver. The receiver passes microphone audio to the PVS AV switcher and speakers which evenly distribute sound throughout the room.

(3) Each pendant microphone shall have volume control, a power switch, an auxiliary mic input, and a function button.

(4) The microphone will have an instant alert feature that may be configured to allow the instructor to request assistance in the classroom.

(5) The microphone shall be based on an industry standard radio frequency technology operating in a spectrum reserved exclusively for voice communications. This technology should not be effected by environmental factors, such as windows, sunlight, and florescent lighting, that create problems for infrared systems.

(6) VoiceLift Handheld Microphone

(7) The wireless handheld microphone is intended for use as a pass around microphone for student participation or team teaching. It should be lightweight, easy-to-hold, and feature an anti-roll collar to keep it from rolling off flat surfaces.

(8) Each microphone shall have a power switch and an auxiliary input to use for a MP3 player or other audio source.

(9) The microphone shall be based on an industry standard radio frequency technology operating in a spectrum reserved exclusively for voice communications. This technology should not be effected by environmental factors, such as windows, sunlight, and florescent lighting, that create problems for infrared systems.

(10) VoiceLift Wireless Receiver

(11) The receiver shall wirelessly connect with pendant and handheld microphones, and pass their audio signals to the dedicated VoiceLift Receiver input of a PVS AV Switcher.

(12) The receiver shall support pairing with up to two room microphones.

(13) The receiver shall be based on an industry standard radio frequency technology operating in a spectrum reserved exclusively for voice communications. This technology should not be effected by environmental factors, such as windows, sunlight, and florescent lighting, that create problems for infrared systems.

(14) VoiceLift Wireless Microphone Charging Station

(15) This device is constructed of high impact ABS plastic and acts as a holding and charging station of up to two of the Extron VoiceLift Pro wireless microphones.

5. ADA Section 504 Assisted Listening Devices (ALD):

(1) All classrooms shall have supplementary wiring necessary to support a portable assistive listening devices. Signage complying with applicable provisions of ADA 504, Section 4.30 shall be installed to notify students of the availability of an assistive listening device support.

(2) Provide an audio cable pathway for an Assisted Listening Device (ASD) by using a plenum rated 20-gauge audio cable by making a connection from the audio out of the PVS Switcher/Amplifier to a 3.5mm WPD 101 3.5 mm mono audio jack wallplate.

(3) Adjustment of the output audio levels will be in completed in accordance of the ALD manufactures recommendations.

6. Media Source Interfacing:

The media source equipment shall be connected to the audiovisual system via one or two (1–2) Active (powered) dual input, switching wall plates. These wall plates shall enable the system to display video, graphic data and audio from Laptop computers, tablets, multimedia players, document cameras, streaming devices, tuners, etc.

These active interface transmitters shall be placed in convenient locations throughout the classroom to facilitate easy connection of sources.

a. One or two *(Define Qty and Type)* (1-2) PVT SW HDMI D, Dual HDMI Input Wallplate shall be used to connect two source devices to the system and transmit the video and audio data from either source to the PVS AV switcher.

(1) Active Twisted Pair Transmitter shall transmit high resolution digital video and audio over plenum rated, Cat6 shielded twisted pair cabling to the PVS AV Switcher

(2) Wallplate shall offer two (2) female HDMI and/or one (1) HDMI and one (1) RGB connectors for interfacing with video source devices

(3) Wallplate shall fit in a standard, 2-gang electrical box and feature Decora® type faceplates.

(4) One (1) stereo audio input on 3.5mm mini stereo jack shall be available for each video input

(5) The output of the interface shall be via one (1) female RJ-45 connector

(6) Connection to the PVS AV Switcher shall be via one (1) UL plenum rated plenum rated, Cat6 shielded twisted pair cable.

(7) To ensure correct grounding throughout the transmission cable, the braid shield must make contact with the shielded RJ-45 connector on both ends of the cable.

7. Data Connectivity

The audio video system shall incorporate features that expand access and connectivity to an existing data network

a. The PVS Switcher shall incorporate a four port network switch, allowing a single network drop to provide connectivity for the switcher, the MediaLink controller, ShareLink 250 or GVCCS Audio Codec (optional) and one additional device.

b. The audio video system shall include an IP Link enabled MediaLink controller, also connected to the network switch in the PVS Switcher, allowing remote monitoring, scheduling and control of the system over a data network connection.

8. Energy Efficiency

The audio video system shall incorporate energy conservation features to reduce consumption and lower operating costs.

a. The system shall incorporate an Auto Power Save Mode with fast power-up that automatically deactivates the audio amplifier after 30 minutes of inactivity. The system returns to full power status in less than one second upon signal detection

b. The system shall incorporate a Standby Mode that allows the amplifier and twisted pair transmitters to be deactivated when not in use.

c. The system shall incorporate monitoring and scheduling of system peripherals, such as sources and displays, in order to deactivate them when not in use or transmit an alert to unauthorized use.

B. Gym / Cafeteria Presentation Systems. Provide the following Audio Video System as an all-inclusive system as described below, one system for each room as indicated on Drawings:

1. Audio Source Equipment: Wireless Microphones and Receivers – Shure or approved equivalent

2. Audio Distribution Equipment – Extron.

3. Audio Amplifiers – Extron.

4. Loud Speakers – Flush Ceiling Mount: JBL, Extron. Speaker Clusters: Electrovoice.

5. Video Distribution Equipment – Crestron matrix switcher.

6. Control System Equipment and User Interface – Extron.

7. Assistive Listening – Listen Technolodies.

3 PART 3 - EXECUTION

3.1 GENERAL

A. All equipment and enclosures described in this specification shall be installed plumb and square per manufacturer's instructions.

B. All equipment, except that designated as movable, portable or loose equipment, shall be secured and permanently attached to the permanent structure in a manner which will require the use of a tool (e.g.: screw driver, nut driver, etc.) for removal.

C. All supports shall meet or exceed the load requirements of the intended application with a minimum safety factor of four.

D. Provide support structure and hardware with a SAE Grade 8 load rating (min.).

3.2 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. All devices connected to equipment specified in this section shall bear the UL label and comply with the applicable National Electrical Code (NEC) standards.

3.3 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein. System setup information shall include each components proper mounting and alignment and properly verified signal pathways and operation. Proper system operation and network support control functions shall be verified.

B. Install in accordance with manufacturer's handling and installation instructions.

C. Install in accordance with all local and pertaining codes and regulations

D. Utilize a Contractor with demonstrated experience in projects of similar size and complexity.

E. Equipment shall be configured and in ready to use condition at the end of installation.

F. Energize and commission equipment in accordance with manufacturer's instructions. Commissioning the system shall at minimum, consist of the following:

Install Global Configurator software on PC
Download from www.extron.com, or install from Extron Software Products CD
Make the following MLC cable connections
Local Area Network (LAN)
Classroom Source Devices
Configure MLC 104 IP Plus Series using Global Configurator
Download device drivers for all source and projection devices
Create a new Global Configurator project file
Add a device and set its IP address
Define the location of the new Media Link Controller device
Save the new Global Configurator file
Configure e-mail server
Configure e-mail messages
Configure email and SMS contacts
Assign serial device drivers
Assign IR drivers as needed
Configure the front panel (All buttons are required to have a function assigned: source or control)
Configure associated control modules
Create a shutdown schedule
Create a lamp hour notification
Create a disconnect notice
Build the Global Configurator file
Upload the Global Configurator file
Launch GlobalViewer
Test the MLC's setup for proper control and support of the classroom
Installation of the Extron system is covered in full detail at
http://wwwextroncom/training/indexasp

3.4 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

B. Repair or replace damaged components before Substantial Completion of the project.

C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of the equipment. Remove construction debris from equipment area and dispose of properly.

END OF SECTION 27 41 00

SECTION 27 5313
CLOCK SYSTEMS

PART - 1 - GENERAL

1.01 GENERAL

A. Drawings and general provision of the Contract, including General and other Conditions and other General Requirements sections, apply to the work specified in this section.

A.02 WORK INCLUDED

A. Master Clock / Transmission System
   1. Primary Encoder with GPS Receiver
   2. Primary Internal Transmitter
   3. Primary External Transmitter

B. Wireless Synchronized Devices
   1. Analog Clock
   2. Digital Clock
   3. Alphanumeric Data Display

1.03 RELATED SECTIONS

A. Section 27 0500 - Communications

B. Section 27 5113 – Paging System

1.04 QUALITY ASSURANCE

A. See Section 27 0513

B. All clocks and associated equipment shall be installed in a neat and workmanlike manner.

C. All secondary clocks will be tested and certified for synchronization and Daylight Savings Time adjustment.

1.05 DEFINITIONS

A. GPS: Global Positioning System, a worldwide system that employs 24 satellites in an integrated network to determine geographic location anywhere in the world, and which employs and transmits atomic time, the most accurate and reliable time.

1.06 SYSTEM DESCRIPTION

A. GPS synchronized wireless time system shall continually synchronize clocks, data display units and PA speakers time throughout the facility and wireless PA voice messaging where needed.

B. The system shall synchronize all clocks to each other. The system shall utilize GPS technology to provide atomic time to all its components. The system shall not require any hard wiring (beside AC power) for all its components. Analog clocks shall be battery operated. Clocks shall automatically adjust for Daylight Savings Time.

C. The system shall provide a text messaging to a specific or group of Alphanumeric Data Display units.

D. Analog Clocks shall be synchronized within 2 milliseconds up to 6 times per day, and each clock shall have an internal oscillator that maintains plus or minus one second per day between synchronizations, so that overall clock accuracy shall not exceed plus or minus 0.05 seconds.

E. The system shall include an internal real time clock reference so that failure of the GPS signal shall not cause the clocks to fail in indicating the right time.

F. The system shall provide an 802.3 Ethernet based network interface to enable system remote programming and maintenance.

G. The system shall incorporate a “fail-proof” design so that a temporary power interruption shall not cause failure of the all system. Upon restoration of power, the system shall resume normal operation without the need to reset the system or any of its components.

H. The system shall include a test pager, to notify maintenance personnel of any system malfunction.

1.07 REGULATORY REQUIREMENTS

A. Equipment and components furnished shall be of manufacturer’s latest model.

B. Encoder, Transmitter and receiver shall comply with Part 90 of FCC rules, as follows:

1. This device may not cause harmful interference, and
2. This device must accept interference received, including interference that may cause undesired operation.
3. Transmitter frequency shall be governed by FCC Part 90.35.
4. Transmitter output power shall be governed by FCC Parts 90 and 74.

C. System shall be installed in compliance with local and state authorities having jurisdiction.

1.08 SUBMITTALS

A. Product Data: Submit complete catalog data for each component, describing physical characteristics and method of installation. Submit brochure showing available colors and finishes of clocks.

B. Operating License: If license is required, submit evidence of application for operating license prior to installing equipment. Furnish the license, or if the license has not been received, a copy of the application for the license, to the Owner prior to operating the equipment. When license is received, deliver original license to Owner.

C. Samples: Submit one clock for approval. Approved sample shall be tagged and shall be installed at the location directed.

D. Manufacturer's Instructions: Submit complete installation, set-up and maintenance instructions.

1.09 SUBSTITUTIONS

A. Proposed substitutions, to be considered, shall be manufactured of equivalent materials that meet or exceed specified requirements of this Section.

B. Proposed substitutions shall be identified not less than 10 days prior to bid date.

C. Other systems requiring wiring and/or conduit between master and clocks will not be acceptable.

1.10 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: Company specializing in manufacturing commercial wireless systems with a documented experience of minimum of 10 continuous years.
2. Installer: Company with documented experience in installation of commercial wireless systems.

1.11 DELIVERY STORAGE AND HANDLING

A. Deliver all components to the site in the manufacturer's original packaging. Packaging shall contain manufacturer's name and address, product identification number, and other related information.

B. Store equipment in finished building, unopened containers until ready for installation.

1.12 PROJECT SITE CONDITIONS

A. Clocks shall not be installed until painting and other finish work in each room is complete.

B. Coordinate installation of GPS receiver and external antenna (if used) for access to the roof or exterior side-wall so that the bracket and related fasteners are watertight.

PART - 2 PRODUCTS

2.01 MANUFACTURER

A. GPS synchronized wireless time, voice and data system and its components shall be manufactured by Sapling, Inc, 1633 Republic Road Huntingdon Valley, PA 19006, (215).322.6063 , or approved alternate. Where Sapling parts are called out, appropriate

2.02 CLOCK CONTROLLER

A. The Master Clock / Transmitter shall be the Sapling SMA 3000 or approved alternate. The transmitter shall be:
   1. Capable of transmitting data to wireless analog clock and wireless digital clock
   2. Capable of receiving a signal from an atomic clock web site via the Internet
   3. Controlled via the web

B. Additionally, the master clock shall have software that allows it to:
   1. Act as a (S)NTP Server
   2. Activate a countdown feature on digital clock models

C. The transmitter shall have a programmable auxiliary relay and shall be programmed anywhere from 1—99 seconds. Upon utilization of the relay, the transmitter will be capable of interfacing with a once a day closure or interfacing with intercom systems.

D. The transmitter shall be capable of acting as a repeater while receiving a signal wired or wirelessly from the main transmitter.

E. Web Interface – The master clock 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 or Mozilla Firefox. The interface shall allow the user to program all bell schedules, events, display features, IP settings of the master clock and any system setting that the master clock has.

F. The transmitter shall be capable of transmitting data to the SAL wireless analog clock and the SBL wireless digital clock. The master clock shall be capable of receiving a signal from any SNTP time server via the Internet. The transmitter shall utilize 915–928 MHz frequency–hopping technology. The master clock shall be capable of acting as a repeater while receiving a signal wired or wirelessly from the main master clock. The transmitter shall be FCC compliant, part 15 Section 15,247.

2.03 WIRELESS REPEATER

A. Wireless repeater shall be Sapling SMA 1000.

2.04 ANALOG CLOCK

A. The secondary clock shall be a Sapling SAL Series wireless clock or approved alternate. The clock will be capable of receiving a signal from multiple clocks. The clock shall receive and transmit with 915–928 MHz frequency–hopping technology.

B. The clock is to be capable of transmitting the time simultaneously without interfering with each other. The clocks shall include automatic calibration and a diagnostic function that allows the user to view the quality of the signal, the last time the clock received a correction signal, a gearbox test and a comprehensive analysis of the entire clock.

C. The clock shall have a maximum correction time of five (5) minutes. It shall be designed to be used with the Sapling Transceiver or the Sapling Repeater, which can be regulated via Sapling wireless communication protocol. Upon receipt of the wireless signal, the clock will immediately self–correct.

D. The clock shall have a semi–flush smooth surface ABS case. The dial is to be made of durable polystyrene material. The crystal is to be shatterproof, side molded polycarbonate. Glass and visible molding marks are unacceptable.

E. The classroom and administrative area clocks shall be 12 inches in diameter (minimum), have black hour and minute hands.

F. The Gymnasium clocks shall be 16 inches in diameter (minimum), have black hour and minute hands. Gymnasium clocks shall be protected by a cage specifically designed for such purpose that does not interfere with the readability of the clock.

2.05 DIGITAL CLOCK

A. The digital clocks shall be capable of working in one (1) of the following options:

1. 110 volts AC; the clock receives and transmits time every one (1) minute.
2. 24 volts AC/DC; the clock receives and transmits time every one (1) minute.

B. The elapsed timer shall be capable of working in conjunction with either the four (4) digit or six (6) digit digital clocks and shall have the ability to count down or count up.

PART - 3 EXECUTION

3.01 INSTALLATION

A. Provide Clocks in all rooms as adjacent to paging speakers. Final placement may be field determined. Coordinate with Architect elevations.

B. Clock headend equipment shall be installed in Main Equipment Room.

C. Wireless repeater shall be located in the Telecommunications Room (TR).

3.02 START-UP

A. Synchronize secondary clocks with master clock and Intercom System.

B. Cycle through Daylight Savings Time and verify correct time change on all clocks. Document results and include in as-built documentation.

3.03 TRAINING

A. 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
2. Remote access methodology
3. Build standard daily schedule for purposes of test and verification of operation.

B. Provide two follow-up sessions of one hour each as requested by the Owner. These sessions shall be within 60 days of system acceptance.

END OF SECTION

SECTION 28 1000

ACCESS CONTROL AND INTRUSION DETECTION SYSTEM

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide a complete security access control. System shall include materials and installation, equipment, wiring, materials, accessories, programming, documentation, testing, training and miscellaneous items required for a complete and operational system.

1.02 SUBMITTALS:

A. Submit complete and descriptive shop drawings indicating compliances with the specifications herein. Submit in accordance with Section 01330.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. DMP Intrusion detection to match District Standard

B. Lenel access control to match District Standard.

2.02 EQUIPMENT

A. Refer to Additional Equipment Lists on Drawings and to District Security and Access Control System Standards, attached. System to include single head end (example LNL-X3300 and DMP XR-550) all others to be expansion cards/boards/devices.

B. Lenel-Security Reader Interface – LNL-1300 series 2 for single door application, Lenel-1320 series 2 for dual door application. Provide 1 per card access door indicated plus 25% spare.

C. Card Reader – HID Signo, HID 920PTNNEX00000 black, with glass mount kit.

D. Arm / Disarm Pin Pad – HID Signo 921PNNNEX200000 black.

E. Access Panels – Lenel Enterprise Series.

F. Door override Pin Pad – HID Signo 921PBBBEX20000 white.

G. Motion Detectors – Bosch CK-DT8050A, wall mount.

H. LED indicator lights – FSS SLM300 with ceiling mount base.

I. Lenel LNL-3300 System Controller.

J. DMP Model 322 Transformer.

K. DMP Model 860 Relay Module.

L. DMP 714 model zone expanders.

M. DMP 716 output expanders.

N. Electric strike – Von Duprin 6211 strike.

O. Door Contacts – Interlogic 1078-cw / 2505A-L Wide Gap.

P. Door Controller – LifeSafety Power CNV-(8/16)DRP-MERC-STRD.

Q. Provide surge protection at all power supply locations

2.03 CABLES

A. Card reader or pin pad to LNL1300/1320 – 22/8 stranded, shielded with orange jacket.

B. Data bus to LNL 1300/1320 – 24 Ga 2 pr shielded PVC. Belden 88102 with orange jacket.

C. Power to electric door hardware / Electric panics – 12/2 stranded with orange jacket.

D. Electric Strikes / Lever sets – 16/2 stranded with orange jacket.

E. Door contacts / motion detectors – 22/4 stranded with orange jacket.

F. Sirens – 16/2 stranded with orange jacket.

G. LX bus to output modules and zone expanders – 18/4 stranded with orange jacket.

H. DMP keypad – 18/4 stranded with orange jacket.

I. Provide service loop above each device.

J. Cables shall be plenum rated where applicable.

2.04 DOOR ENTRY VIDEO INTERCOM SYTSTEM

A. Video Door Entry Station:

1. Aiphone, Model JF-DVF.

2. Or approved equivalent.

B. Master Station:

1. Aiphone, Model JF-2MED.

2. Or approved equivalent.

C. Slave Station:

1. Aiphone, Model JF-2HD.

B. Or approved equivalent.

PART 3 EXECUTION

3.01 INSTALLATION

A. The installation shall be accomplished with quality materials in a neat and professional manner. Materials under this section or other sections of the specifications damaged during this installation shall be replaced with new materials at no additional cost to the Owner.

B. Prior to beginning work, hold a coordination meeting to coordinate all interfaces between equipment, rough-in requirements, phasing issues, etc.

C. Verify location of access controller board and CPU with Owner.

D. Sensors and other devices shall be mounted where indicated.

E. Remote reader electronics and junction boxes shall not be installed in inaccessible ceilings. They shall be located in the nearest accessible ceiling and all wiring piped to the security devices.

F. Provide conduit for all wiring in walls, inaccessible spaces, and all wiring below 8'. J-hooks or other approved mounting devices may be used above accessible ceilings where cable trays are not installed. Provide sleeves through floors, walls, and structure between outlet and cable tray or terminal board.

G. All electrified doors, regardless of card reader or keypad shall have access control wiring to electronic hardware or controllers.

3.02 PROGRAMMING

A. Provide points/device list to Owner four weeks in advance of programming. Owner will provide naming system for all items which is to be incorporated into the programming in I/O through Lenel and DMP

B. Owner will provide Contractor with access to Owners program upon verification they are a certified dealer of Lenel and an experienced DMP, Bosch, etc. system installer.

C. Contractor is required to add Lenel segment for new building, head-end, and all controllers. Program all devices into system and as requested for I/O actions. Program all lockout,

lockdown, and provide 10 timezones all linked to lockdown and lockout actions. Owner will provide access levels for cardholders upon completion of programming.

D. DMP integration to Lenel is required for arm/disarm functions for all security zones. Owner will provide zone information upon request. Program all devices to support these zones.

3.03 TRAINING

A. Provide 6 hours of on-site training utilizing the system. Training shall include at minimum the following: Walkthrough of panel and power supply locations. Walk through and verification of door override programming prompts with lockdown and lockout sequences. Verification of LED light indicators At end of training, provide a certification letter indicating the training was given and understood by the attendees.

END OF SECTION

SECTION 28 3110
FIRE ALARM / VOICE EVACUATION SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install a complete and satisfactory operating automatic fire alarm / voice evacuation and detection system.

B. System to include control panel, detection devices, notification appliances, manual stations, digital alarm communicating transmitter, remote annunciator, accessories, raceways, wiring, batteries, and any other necessary accessories and installation materials.

C. Provide plans, specifications, equipment list and calculations for permit review by the Fire Marshall.

D. Include 20 hours of programming labor that is to be used as requested by Owner during the 1 year warranty periods.

1.02 DESCRIPTION OF SYSTEM

A. Supervised non-coded annunciated multiplex style, addressable, solid state system with intelligent analog alarm initiation.

B. System Operation:
1. Alarm Caused By: Activation of any automatic detection or manual device, or water flow within sprinkler system.
2. Alarm Initiation to Cause:
   a. Audible and visual zone identification at Control Panel and annunciators.
   b. Lamp to light in base of initiating detector; or if detector is concealed from view, light a remote lamp at nearest visible location.
   c. Closing of selected supply air dampers and HVAC units.
   d. Transmission of alarm to remote monitoring station via 2 line automatic telephone dialer.
   e. All smoke and fire doors to close.
   f. All speakers to play voice-evacuation message.
   g. All strobes to flash.
3. Audible alarm may be manually silenced at Control Panel. Alarm signal circuit and zone alarm light shall remain initiated until actuated devices have been restored to normal and Control Panel reset.
4. Trouble Signal Caused By:
   a. An open or short in detector or signaling loop wiring.
   b. Removing any initiating or signaling device from system.
   c. Moving any sprinkler system valve from the full open position.
   d. Failure of battery charger.
5. Trouble initiation to cause: audible and visual indication at the Control Panel.
6. Audible trouble indication may be silenced at Control Panel. Trouble circuit and zone light to remain initiated until trouble corrected.
7. Trouble circuit to be self-restoring after correction of problem, or have automatic "ring-back" if left in silenced condition.
8. Alarm shall override trouble.

1.03 PLAN SUBMITTAL AND INSPECTION REQUIREMENTS

A. Plans and Specifications submittal: Three complete plans and specifications for fire alarm systems shall be submitted for review and approval prior to system installation. Plan review fees must be paid before picking up the approved set of plans. Plans and specifications shall be submitted to the Permit and Information Center. Provide owner with a copy of the approved plans.

B. Plans and specifications shall include, at minimum, the following information. Provide additional information as required by Fire Marshall:
   1. Floor plan with rooms labeled and occupancy use noted.
      a. Location of all initiating, notifications devices, control panel, and remote annunciator.
      b. Mounting heights and ceiling description where detectors are installed.
   2. Point to point system wiring diagram
      a. Devices, controls, and end-of-line location for each circuit.
      b. Number of conductors and wire gauge for each circuit run
      c. Zone identification
   3. Voltage drop calculation
      a. Devices, length, resistance of wire, and end-of-line voltage for each circuit
   4. Battery calculation.
   5. Other information required by the local authority having jurisdiction.

C. Location and Security: The alarm control unit, remote annunciator panel, and access keys to locked fire alarm equipment shall be installed and maintained in a lock box location approved by the Fire Marshall. Lockbox to be provided by the Contractor. Written operating instructions shall be provided within the alarm control unit. Lock box to meet requirements of fire marshal.

1.04 CONTRACTOR DESIGN

A. The equipment shown on the Contract Drawings is to indicate the minimum system required, but may not show all of the Code required components. It is the responsibility of the Contractor to provide a complete fire alarm and communications system as needed to meet all applicable Codes and requirements under this section

B. Raceway, routing, and wiring for the devices are not shown.

1.05 REFERENCE STANDARDS

A. NFPA 72: National Fire Alarm Code

B. NFPA 101: Life-Safety Code.

C. Uniform Fire Code

D. Oregon Structural Specialty Code

E. UL-STD 864, UL-UOJZ.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. FireLite MS9600UDLS, ECC-50/100, ECC-LOC, to match District standard. SNAC panels – Firelite or Silent Knight 5499.

2.02 VOICE EVACUATION MASTER PANEL

A. Features:
   1. Solid-state. "Mother/Daughter" board configuration.
   2. Plug-in modules.
   3. Separately fused inputs.
   4. Multiple two wire addressable communication loops for zones and devices required.
   5. Supervision and sensitivity testing of all circuits and devices.

6. All necessary 24 VDC power supplies.
7. Alarm reset switch.
8. Ground fault indicator.
9. Lamp test switch or lamp supervision.
10. Trouble silencing switch: self-restoring, or with ring-back.
11. Separate system trouble indicator: Supervises circuits and control panel wiring.
12. Audible and visual trouble indication including location and address of device. Visual indication shall be English language readout.
13. Power-on indicator.
14. Separate supervised alarm and trouble indicators for each circuit.
15. Detector circuit to accommodate intermixing of all types of detection and contact devices without resistors or circuits compensating devices at each initiating device.
16. Terminals for remote annunciators and controls.
17. Addressable auxiliary contacts: Two each NO/NC for alarm and trouble.
18. Fire drill switch and an audible alarm silence switch.
19. Detector sensitivity, calibration and identification to be supervised by control panel. Detector sensitivity capable of being changed from the control panel.
20. Amplifiers shall be provided as necessary.

B. Prerecorded Message:
1. Voice system shall be able to record and store a 60 second message.
2. The recorded message shall include evacuation instructions and shall be approved by the Fire Marshall.

2.03 FIREMAN'S TELEPHONE SYSTEM

A. Provide a two-way, supervised voice communications system for fireman use. Provide lamp and tone indicators when phone is plugged into jack.
B. Provide phone jacks at each stairwell landing, elevator lobby, and elevator cab.
C. Provide locking cabinet at Fire Alarm Master Panel location with 6 phones for fireman use.

2.04 STANDBY POWER

A. Operation:
1. Upon loss of primary power or drop in primary voltage, system shall automatically transfer to battery power without loss of signal.
2. An indicator lamp and pulsing audible annunciator shall indicate when system is on emergency power.

B. Storage Battery:
1. Integral battery to provide 24 hours operation and then sound all alarm signals for at least five (5) minutes, per NFPA 72.
2. 24 volts DC.
3. Battery charger.
4. Battery overcurrent protection.

2.05 MANUAL STATIONS

A. Addressable non-coded semi-flush mount, single-action, fully compatible with ionization and thermal detectors. Key reset, so that once station has been pulled, it cannot be reset by unauthorized personnel. Bright red finish. Engraved "FIRE ALARM."

B. Acceptable Model: Firelite BG12LX.

C. Provide protective shields for all manual pull stations unless otherwise noted. Tamper-proof, clear lexan shield and red frame that easily fits over manual pull stations. When shield is lifted, it sounds a loud, piercing warning horn. Battery-operated horn. Acceptable Example Model: Safety Technology International Stopper II.

2.06 THERMAL DETECTORS

A. Addressable Combination Rate of Rise/Fixed Temperature:
   1. Plug-in base, interchangeable with other detectors, 2-wire loop operation.
   2. Alarm indicator lamp.
   3. Rate of Rise Initiation: 15°F rise over a one-minute period.
   4. Fixed temperature initiation: 135°F or 200°F, as shown.
   5. Integral communications and built-in device type identification.

B. Acceptable Model: Firelite H355R.

2.07 SMOKE DETECTORS

A. Features:
   1. Optical sensing, photoelectric type addressable smoke detector.
   2. No moving parts.
   3. Alarm indicator LED to pulse only for trouble and alarm signals.
   4. Capable of having sensitivity tested and adjusted.
   5. Nominal 24V DC 2-wire loop operation.
   6. Provision for connecting a remote alarm lamp.
   7. Terminal base connection.
   8. Concealed socket head screw to prevent tampering.
   9. Integral communications and built-in device type identification.
   10. The detector shall be capable of bi-directional communication with the control panel.
   11. The detector shall be dynamically supervised and uniquely identifiable by the control panel. The control panel shall be capable of analyzing the signal of the detector's analog value for calibration, identification and sensitivity. These values can be displayed by the control panel and monitored for processing according to control panel instructions. The detector's sensitivity shall be individually adjustable from the control panel. Should the detector sensitivity voltage shift beyond an acceptable level and stay there for a predetermined length of time, a discrete detector trouble signal shall be annunciated at the control panel.

B. Duct detectors shall be similar with duct mounting enclosure, sampling tubes, remote test and reset station. Provide relay base with each duct detector. Connect to shut down associated HVAC unit upon alarm.

C. Acceptable model: Firelite SD355 smoke detector, D355PL with CRF300 relay module duct detector.

2.07 SPEAKER/STROBE

A. Speaker:
   1. Field selectable taps for 1/8, 1/4, 1/2, 1, 2 Watt operation.
   2. 3 selectable dBA levels: 90, 95, 99 dBA Anechoic at 10’ for both tones.

B. Strobe:
   1. Capable of being synchronized by adding synchronization module.
   2. 0.2 sec maximum pulse duration with 40% duty cycle.
   3. Flash rate of 1 Hz to 2 Hz.
   4. Clear or nominal white light source not to exceed 1000 cd.
   5. Minimum intensity: 75 candela. 15/75 candela unit is not acceptable.

C. Audio and strobe inputs shall be supervised.

D. Acceptable Model: Wheelock Exceder LED High Fidelity series in red.

2.08 SPEAKER

A. Field selectable taps for 0.125, 0.25, 0.5, 1, 2 Watt operation.

B. Input shall be supervised.

C. Acceptable Model: Wheelock Exceder LED High Fidelity series in red.

2.09 LOUDSPEAKER

A. Field adjustable for 0.5 to 15 Watt operation.

B. Input shall be supervised.

C. Vandal resistant, weatherproof

D. Acceptable Model: Wheelock HSR and Wheellock AH-24WP-R exterior series.

2.10 ELECTRONIC STROBE

A. Capable of being synchronized by adding synchronization module.

B. 0.2 sec maximum pulse duration with 40% duty cycle.

C. Flash rate of 1 Hz to 2 Hz.

D. Clear or nominal white light source not to exceed 1000 cd.

E. Input shall be supervised.

F. Minimum intensity: 75 candela. 15/75 candela unit is not acceptable.

G. Acceptable Model: Wheellock STR.

2.11 REMOTE ANNUNCIATOR

A. Furnish and install where shown on the drawings, serial LCD annunciators incorporating the following features:
   1. Two line by 40 character LCD display, displaying clear English language information.
   2. Control switches for system acknowledgements, alarm silence and system reset.
   3. Supervised from fire alarm master control panel.
   4. Annunciator shall be framed in an architectural gray, extruded aluminum frame.
   5. Annunciators shall be mounted as indicated on the drawings.

B. Acceptable Example Model: Firelite ANN80.

2.12 DOOR HOLDERS

A. Furnish and install where shown on the drawings, magnetic door holders.

B. Acceptable Example Model: Rixson model 999.

2.13 WIRING

A. Type:
   1. UL listed limited energy cable for fire protective signaling, FPLP.
   2. Conductors: Minimum size No. 18 AWG, solid, color coded, shielded where required by manufacturer.
   3. Overall PVC jacket, plenum rated, red color.
   4. Belden Fire Alarm Tray Cable or equivalent.

B. Size: The sizes and quantity of the different wires shall be those specified by the manufacturer. Color code shall be used where specified.

PART 3 - EXECUTION

3.01 WIRING

A. Raceway:
   1. Raceway not required where wiring is accessible and concealed above ceiling or in chase. Raceway is required in all other areas.
   2. Install surface non-metallic raceway for surface wiring in finished areas. Install conduit in all other areas where raceway is required.

B. Wire:
   1. All wires shall be tagged at all junction points and shall be free from ground or crosses between conductors.
   2. One-inch conduit between the FACP and the central station transmitter connection as indicated. Install number of conductors and electrical supervision for connecting wiring as required to suit central-station monitoring function. Provide telephone conductors, jacks, and boxes for connection between transmitter and MPOP.

3.02 INSTALLATION

A. Manufacturer to provide supervision of installation and make final connection of tagged wiring.

B. Maintain existing system fully operational until new has been tested and accepted. As new equipment is installed label existing equipment "NOT IN SERVICE UNTIL ACCEPTED".

C. Ground equipment and conductor and cable shields. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

D. The Contractor shall provide for a communication line from the fire alarm master to the Sonitrol security panel for monitoring alarm conditions. The Contractor shall pay all costs associated with connecting to the Sonitrol panel.

E. Door holders shall be connected to the Security and Access control master to allow release of doors for security purposes.

3.03 FIELD QUALITY CONTROL

A. Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

B. Pretest: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Pretest shall include the following:
   1. Determine the conformance of the system to the requirements of the Drawings and Specifications.
   2. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
   3. Perform sound level test. Adjust volume of all speakers to minimum level required to maintain sound levels of 15 dB above ambient sound levels throughout building. Retest sound level with owner present and note sound level setting of all horns on drawings. Notify owner if additional speakers are required.
   4. Prepare forms for systematic recording of acceptance test results.

5. After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

C. Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

D. Final Acceptance Test: Test the system according to the procedures outlined in NFPA 72. Minimum required tests are as follows:
1. Verify the absence of unwanted voltages between circuit conductors and ground.
2. Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1-megaohm for evaluation.
3. Test all conductors for short circuits utilizing an insulation-testing device.
4. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.
5. Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
6. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
7. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
8. Test the system for all specified functions according to the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
9. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.

E. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

F. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

G. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

3.04 CLEANING AND ADJUSTING

A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

3.05 DEMONSTRATION

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours training.
2. Schedule training with the Owner at least seven days in advance.

3.06 CERTIFICATION

A. The installer shall provide written certification to the fire marshal and to the Owner that the system has been installed in accordance with the approved plans and specifications.

END OF SECTION

SECTION 31 1000

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Protecting existing trees and vegetation to remain.
   2. Removing existing trees and other vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing site utilities.

1.02 SUBMITTALS

A. Product Data for each type of product indicated.

1.03 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to remain on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site and disposed of properly.

1.04 PROJECT CONDITIONS

A. Traffic: minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree and vegetation-protection measures are in place.

E. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

1.05 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter, sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures. Requirements for temporary erosion-and-sedimentation-control are specified in Section 31 25 00 “Erosion and Sedimentation Controls.”

3.03 TREE AND VEGETATION PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements below.

B. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

C. Do not excavate within tree protection zones, unless otherwise indicated.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner.

E. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
   3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
   4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

3.04 UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Completely remove stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   4. Use only hand methods for grubbing within protection zones.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.07 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, and gutters at existing full-depth joints unless indicated otherwise. Neatly saw-cut length of existing pavement to remain with vertical faces prior to removing existing pavement.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION 31 2000

EARTH MOVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preparing subgrades
   2. Excavating and backfilling for buildings and structures.
   3. Drainage course for concrete slabs-on-grade.
   4. Base course and subbase course for concrete pavements.
   5. Base course and subbase course for asphalt paving.
   6. Excavating and backfilling for utility trenches.

1.02 SUBMITTALS

A. Product Data.

B. Aggregate Sieve Analysis.

C. Growing media: (at least 14 days in advance of construction).
   1. Documentation for the two analyses described in article 2.1.N.1 and 2.1.N.2 of this specification (particle gradation with calculated coefficient of uniformity; and pH) shall be performed by an accredited laboratory with certification maintained current. The date of the analyses shall be no more than 90 calendar days prior to the date of the submittal. The report shall include the following information:
      a. Name and address of the laboratory.
      b. Phone contact and e-mail address for the laboratory.
      c. Test data, including the date and name of the test procedure.
   2. A compost technical data sheet from the compost vendor. The analysis and report must conform to the sampling and reporting requirements of the US composting Council Seal of Testing Assurance (STA) program. The analysis shall be performed and reported by an approved independent STA program laboratory and be no more than 90 calendar days prior to the date of submittal.
   3. Two gallon-sized bags of the blended material.
   4. A description of the location, equipment, and method proposed to mix the material.

D. CDF: Design mix and trial 28-day compressive strength test results.

1.03 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course, or subgrade, and concrete, or hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or cement concrete.

J. Subgrade: Surface or elevation remaining after completing excavation, or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

L. Drainage Fill: Free draining, open-graded aggregate course used to support pervious pavement or in drainage zones in flow-through planters, vegetated stormwater facilities and infiltration galleries.

M. Growing media: Non-native soil mixture made up of sand, loam, and compost; used on surface stormwater facilities.

N. Unified Soil Classification System:
1. GW: Well-graded gravels; gravel/sand mixtures with little or no fines.
2. GP: Poorly-graded gravels; gravel/sand mixtures with little or no fines.
3. GM: Silty gravels; poorly-graded gravel/sand/silt mixtures.
4. GC: Clayey gravels; poorly-graded gravel/sand/clay mixtures.
5. SW: Well-graded sands' gravelly sands with little or no fines.
6. SP: Poorly-graded sands; gravelly sands with little or no fines.
7. SM: Silty sands; poorly, graded- sand/gravel/silt mixtures.
8. SC: Clayey sands; poorly-graded sand/gravel/clay mixtures.
9. ML: Inorganic silts; sandy, gravelly, or clayey silts.
10. CL: Lean clays; inorganic, gravelly, sandy, or silty, low to medium-plasticity clays.
11. OL: Organic, low-plasticity clays and silts.
12. MH: Inorganic, elastic silts; sandy, gravelly or clayey elastic silts
13. CH: Fat clays; high-plasticity, inorganic clays.
14. OH: Organic, medium to high-plasticity clays and silts
15. PT: Peat, humus, hydric soils with high organic content.

1.04 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

C. Site Information: Research public utility records and verify existing utility locations prior to ordering any material. Notify the Architect immediately if any discrepancies are found in the project survey.

D. See Geotechnical report titled Report of Geotechnical Engineering Services by GeoDesign dated March 1, 2021 for additional information and requirements.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials ~~when sufficient satisfactory soil materials are not available from excavations~~for all site fill.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Use Oregon Standard Specifications for Construction 3/4-inch-0" BASE AGGREGATE.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 3-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Use Oregon Standard Specifications for Construction 3/4-inch-0" BASE AGGREGATE.

H. Drainage Course: Narrowly graded mixture of washed**,** crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Backfill and Fill:
   1. Satisfactory soil materials
   2. Initial trench backfill: Use Oregon Standard Specifications for Construction 3/4-inch-0" BASE AGGREGATE.

J. Drainage Fill: Angular, granular material with a maximum particle size of 2 inches and shall meet Oregon Standard Specification 00430.11. The material shall be free of roots, organic material, and other unsuitable materials; have less than 2 percent passing the No. 200 sieve (washed analysis); and have at least two mechanically fractured faces.

K. Growing Media: A loose and friable material blend of loamy soil, sand and compost that is 30-40 percent compost (by volume) and meets the following other criteria:
   1. Particle Gradation: A sieve analysis of the complete blended material shall be conducted per ASTM C117/C136, AASHTO T11/T27, or ASTM D422/D140 and meet the following gradation criteria:

Sieve Size	Percent Passing
1-inch	100
#4	75-100
#10	40-100
#40	15-50
#100	5-25
#200	5-15

   2. The blend shall have a coefficient of uniformity (D60/D10) equal to or greater than 6 to ensure it is well graded.
   3. Acidity: pH of the blended material shall be tested and be between 6 and 8.
   4. Compost: The compost shall be derived from plant material and provided by a member of the US Composting Council Seal of Testing Assurance (STA) program. See www.compostingcouncil.org for a list of local providers. The compost shall be a result of biological degradation and transformation of plant-derived materials under conditions designed to promote aerobic decomposition. The material shall be well composted, free of viable weed seeds, and stable with regard to oxygen consumption and carbon dioxide generation. The compost shall have no visible free water and produce no dust when han-

dled. It shall meet the following criteria, as reported by the US Composting Council STA Compost Technical Data Sheet provided by the vendor.

a. 100 percent of the material must pass through a ½ inch screen.
b. The pH of the material shall be between 6 and 8.
c. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0 percent by weight.
d. The organic matter content shall be between 30 and 70 percent (dry weight basis).
e. Soluble salt content shall be less than 6.0 mmhos/cm.
f. Maturity indicator shall be greater than 80 percent for Germination and Vigor.
g. Stability shall be 'Stable' to 'Very Stable'.
h. Carbon/Nitrogen (C/N) ratio shall be less than 25:1.
i. Trace metals test result= 'Pass.'

5. Blend: The material shall be well mixed and homogenous. It shall be free of wood pieces, plastics, and other foreign matter. There shall be no visible free water. It shall be sourced from a source known to be free of horsetail.
6. Infiltration: The blended material shall have a minimum infiltration rate of **2.5** inches per hour. Contractor shall provide the Engineer with a 2 quart sample for initial testing.

L. Controlled Density Fill (CDF), also referred to as "Controlled Low Strength Material (CLSM): Highly flowable, lean concrete mix of fly ash, cement, fine aggregates, water and admixtures meeting the following other criteria:
1. Portland Cement: ASTM C150, Type I or II.
2. Aggregates: Non-expansive or reactive with 100 percent passing a 3/8-inch sieve and less than 10 percent passing the No. 200 sieve. Aggregates shall meet the requirements of ASTM C33.
3. Fly ash: Conform to ASTM C618, Class F unless otherwise approved.
4. Water: Potable.
5. Admixtures: As necessary to improve flowability without segregation.
6. Compressive Strength: CDF shall attain a 28-day compressive strength of 100 psi – 200 psi.

2.02 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction or as follows:
1. Red: electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Tracer Wire: 12 AWG minimum solid copper insulated High Molecular Weight Polyethylene (HMW PE) tracer wire or approved equal. The tracer wire insulation shall be green for sewer pipe and blue for waterlines and be a minimum of 45 mil. thick. Joints or splices shall be waterproof. The wire shall be rated for 30 Volt.

C. Impermeable liner: PVC or HDPE Geo-membrane textured on both sides, 30 mil (.076mm) minimum.

D. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
1. Grab Tensile Strength: 110 lbf ; ASTM D 4632.
2. Tear Strength: 40 lbf ; ASTM D 4533.
3. Puncture Strength: 220 lbf ; ASTM D 4833.

4. Apparent Opening Size: No. 40 ; ASTM D 4751.
5. Permativity (minimum): .5 sec^{-1}; ASTM D 4491.

E. Separation Fabric: Woven geotextile, specifically manufactured as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
1. Grab Tensile Strength: 180 lbf ; ASTM D 4632.
2. Tear Strength: 68 lbf ; ASTM D 4533.
3. Puncture Strength: 371 lbf ; ASTM D 4833.
4. Apparent opening size: No. 30; ASTM D 4751.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations. Provide protective insulating materials as necessary.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section “Site Clearing.”

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section “Site Clearing” and “Erosion and Sediment Control” and on the approved 1200-C permit during earth moving operations.

D. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

F. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

G. Protect all areas designated to be infiltration facilities from foot or equipment traffic and surface water runoff. Do not use proposed infiltration facilities to dispose of surface water runoff during construction. Under no circumstances shall material and equipment be stored on top of the installation area. Contractor shall not backfill facility until Engineer has inspected it and signed off.

H. Protect all areas designated to receive pervious pavers or pervious pavement from excessive compaction.

~~H.~~I. In places where new fill is placed, the weight of the new fill could cause settlement of underlying soil. Where more than 3 feet of new fill will be placed over existing undocumented fill or native clay, monitor settlement using survey hubs. Confirm settlement is complete before structures are constructed.

3.02 WET WEATHER CONSTRUCTION

A. It is considered wet weather when subgrade is wet of optimum and at all times between October and May.

B. During wet weather, install a minimum of 18 inches of compacted base course or engineered fill on separation fabric for all areas exposed to construction traffic.

~~3.02~~3.03 EXPLOSIVES

1. Explosives: Do not use explosives.

~~3.03~~3.04 EXCAVATION

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions without prior approval by the Architect.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

~~3.04~~3.05 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   ~~1.~~2. Where undocumented fill or expansive clay is present at footing elevations, remove subgrade soil and replace with compacted base course to create a 3 foot thick granular pad. Depth of pad may be reduced where sandstone is encountered within 3 feet. Granular pads should extend at least 6 inches beyond the margins of the footings for every foot of depth.

~~3.05~~3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

~~3.06~~3.07 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 6 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade and bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course. Hand excavate for bell of pipes.
   2. Excavate utility structures to provide 6 inches clearance (enlarge as needed) to allow for compaction of backfill material.

~~3.07~~3.08 SUBGRADE INSPECTION

A. Proof-roll subgrade with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Do not proof-roll subgrade in infiltration facilities.
   1. Subgrade inspection shall be observed by a geotechnical engineer.

B. Soft pockets and areas of excess yielding that have been identified shall be scarified and moistened or aerated, or removed and replaced with suitable soil materials to the depth required. Re-compact and retest until specified compaction is obtained.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

~~3.08~~3.09 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

~~3.09~~3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

~~3.10~~3.11 BACKFILLS AND FILLS

A. Backfill: Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for record documents.
   3. Inspecting and testing underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

~~3.11~~3.12 UTILITY TRENCH BEDDING

A. Place bedding on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

~~3.12~~3.13 UTILITY TRENCH BACKFILL

A. Trenches under Footings: Backfill trenches excavated under footings with satisfactory soil or approved backfill to within 18 inches from the bottom of footings elevation; fill remaining trench excavation with concrete up to the elevation of bottom of footings. Concrete is specified in "Cast-in-Place Concrete."

B. Place and compact initial trench backfill material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

C. Place and compact final backfill of satisfactory soil to final subgrade elevation.

D. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

E. Install tracer wire in a continuous fashion above the utility in such a manner as to be able to properly trace utility lines without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire. Bring tracer wire to the surface at every box, vault, drainage structure, or manhole.

~~3.13~~3.14 DRAINAGE FILL

A. Compaction of the native soil subgrade should be limited in order to prevent a reduction in the permeability of the soil.
   1. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and underlying soils scarified to a minimum depth of 3 inches with a York rake or equivalent and light tractor.
   2. Where subgrade has been compacted due to construction traffic, subgrade shall be scarified or removed to a depth sufficient to match the naturally occurring insitu state. Add additional base course material to meet design grades at no cost to the owner.
   3. Bring subgrade of base course to line, grade, and elevations indicated. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing of stone.

B. Place drainage geotextile over prepared subgrade, overlapping ends and edges at least 12 inches. Secure in place to prevent wrinkling.

C. Place drainage fill and compact by tamping with a plate vibrator, and screed to depth indicated. For drainage fill that exceeds 8 inches in compacted thickness, place fill in layers of equal thickness, with no compacted layer more than 8 inches or less than 4 inches thick.

D. Place drainage geotextile over compacted drainage fill, overlapping ends and edges at least 12 inches.

~~3.14~~3.15 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use base course.
   3. Under steps and ramps, use base course.
   4. Under building slabs, use base course.
   5. Under footings and foundations, use engineered fill.
   6. Under and around utility structures, use engineered fill.

~~3.15~~3.16 STORMWATER INFILTRATION FACILITY FILL

A. Growing media shall be placed in loose lifts, not to exceed 8 inches each.

B. Placement of the growing media will not be allowed when the weather is too wet as determined by the owner's representative.

~~3.16~~3.17 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.

~~3.17~~3.18 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

D. Growing media shall be compacted with a water-filled landscape roller. It shall not otherwise be mechanically compacted.

~~3.18~~3.19 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1/2 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

~~3.19~~3.20 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Shape subbase course and base course to required crown elevations and cross-slope grades.
   2. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

~~3.20~~3.21 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   2. Compact each layer of drainage course to required cross sections and thicknesses to not less than **95** percent of maximum dry unit weight according to ASTM D 1557.

~~3.21~~3.22 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing Agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and building slab areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length, but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

E. With the approval of the Engineer, proof-roll testing of subgrade and/or aggregate base may be substituted for other compaction testing.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

~~3.22~~3.23 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

D. Weather permitting and as approved, stormwater infiltration facility plants shall be installed as soon as possible after placing and grading the growing media in order to minimize erosion and further compaction.

~~3.23~~3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 25 00

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY:

A. This section includes the following:
   1. Prevention of erosion due to construction activities.
   2. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

1.02 PERFORMANCE REQUIREMENTS

A. Comply with all requirements of U.S. Environmental Protection Agency for erosion and sedimentation control, as specified for the National Pollutant Discharge Elimination System (NPDES), under requirements for the 2012 General Permit for Discharges from Construction Activities.

B. Also comply with all more stringent requirements of State of Oregon Erosion and Sedimentation Control Manual.

C. Follow an Erosion and Sedimentation Control Plan.

D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

E. Revisions to ESCP: Keep copies of all ESCP revisions on site. There are three ways to inform DEQ or an Agent of revisions to the ESCP:
   1. Submit ESCP revisions by email to DEQ or its Agent when revisions to the ESCP are minimal and identify in the email the particular changes. Submit only portions of the ESCP that have changed.
   2. Submit the revisions by redlining the copy of the original ESCP or drawings. Submit only drawings that have changes.
   3. When the ESCP requires extensive revisions, submit the entire revised ESCP to DEQ.

F. ESCP revisions must be submitted to DEQ if they are made for any of the reasons listed below:
   1. Changes for emergency situations: When immediate corrective actions are required to cease the discharge of significant amounts of sediment entering surface waters or nearby properties, the ESCP revisions must identify the corrective actions taken to cease the discharge, if such actions require a change to the ESCP or a change in the method(s) of implementing the ESCP, (for example, increased inspection frequency). Submit the ESCP to DEQ within ten calendar days of the discharge identifying the corrective actions taken to cease the discharge. Approval of the revisions by DEQ or its Agent prior to implementation of corrective actions is not required.
   2. Change (increase or decrease) in the size of the project: Submit revisions to DEQ or its Agent at least 10 days before implementing the revisions. If the permit registrant does not receive a response from DEQ or its Agent within 10 days of receipt, the proposed revisions are deemed approved.
   3. Change (increase or decrease) in the size or location of disturbed areas: Submit revisions to DEQ or its agent at least 10 days before implementing the revisions. If the permit registrant does not receive a response from DEQ or its Agent within 10 days of the receipt, the proposed revisions are deemed approved.
   4. Changes to BMPs: Submit changes in the project design that may affect stormwater discharges, local conditions, or project schedule (for example, schedule delays postpone earthwork to wet weather season so additional controls are needed) must be submitted. In addition, submit changes (such as type or design) to the BMPs identified in the ESCP, their location, maintenance required, and any other revisions necessary to prevent and control erosion and sediment runoff. Submit revisions to DEQ or its Agent at least 10 days

before implementing the revisions. If the permit registrant does not receive a response within 10 days of receipt, the proposed revisions are deemed approved.

5. Change in the erosion and sediment control inspector: Submit name, contact information, and qualifications to DEQ or its Agent. If the permit registrant does not receive a response from DEQ or its Agent within 10 days of receipt, the inspector(s) are deemed approved.
6. Changes that DEQ or Agent requests: DEQ or Agent may require the permit registrant to submit ESCP revisions at any time if the ESCP is inadequate to prevent the discharge of significant amounts of sediment or turbidity to surface waters or to conveyance systems that discharge to surface waters.

G. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

H. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

I. Inspections:
   1. Inspections must be conducted by a person who:
      a. Is knowledgeable in the principle and practice of erosion and sediment controls, and
      b. Possesses the skills to assess conditions at the construction site that could impact stormwater quality, and
      c. Is knowledgeable in the correct installation of the erosion and sediment controls, and
      d. Is able to assess the effectiveness of sediment and erosion control measures selected to control the quality of stormwater discharges from the construction activity.
   2. Visual monitoring requirement: all areas of the site disturbed by construction activity must be inspected to ensure that BMPs are in working order. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking as well as areas used for storage of materials that are exposed to precipitation for evidence of spillage or other potential to contaminate stormwater runoff. In addition, inspect all discharge points identified in the ESCP for evidence of or the potential for the discharge of pollutants, and to ascertain whether erosion and sediment control measures are effective in preventing significant impacts to surface waters. Where discharge points are inaccessible, nearby downstream locations must be inspected to the extent that such inspections are practicable.
   3. All ESCP controls and practices must be inspected according to the following schedule:

Site Condition	Minimum Frequency
1. Active Period	Daily when stormwater runoff, including runoff from snowmelt, is occurring. At least once every two weeks, regardless of whether stormwater runoff is occurring.
2. Prior to the site becoming inactive or in anticipation of site inaccessibility	Once to ensure that erosion and sediment control measures are in working order. Any necessary maintenance and repair must be made prior to leaving the site.
3. Inactive periods greater than 14 consecutive calendar days	Once every 2 weeks.
4. Periods during which the site is inaccessible due to inclement weather	If practical, inspections must occur daily at a relevant and accessible discharge point or downstream location

4. Recordkeeping Requirements: Document all visual inspections in an onsite logbook. If there are no findings, simply record the inspection date, and inspector's name. In addition, record any findings, including:
    a. At the designated discharge location(s):
        1) Where to make observations:
            a) At the discharge location if the discharge is to a conveyance system leading to surface waters;
            b) From the discharge point to 50 feet downstream if the discharge is to surface waters; and
            c) At any location where more than 1/2 of the width of the receiving surface water is affected.
        2) How to make observations:
            a) For turbidity and color, describe any apparent color and the clarity of the discharge, and any apparent difference in comparison with surface waters.
            b) Describe any sheen or floating material, or record that it is absent. If present, it could indicate concern about a possible spill or leakage from vehicles or materials storage.
    b. If a site is inaccessible due to inclement weather, record the inspections noted at a relevant discharge point or downstream location, if practical.
    c. Locations of BMPs that need to be maintained, inspections of all BMPs, including erosion and sediment controls, chemical and waste controls, locations where vehicles enter and exit the site, status of areas that employ temporary or final stabilization control, soil stockpile area, and non-stormwater pollution (e.g. paints, oils, fuels, adhesives) controls.
    d. Locations of BMPs that failed to operate as designed or proved inadequate for a particular location;
    e. Locations where additional BMPs are needed that did not exist at the time of inspection; and
    f. Corrective action required and implementation dates.
    g. All inspection records and monitoring results must be kept on site and maintained by the permit registrant. The records shall list the construction site name as it appears on the registrant's permit and the file or site number. These records must be made available to DEQ, Agent, or local municipality upon request. These records must be delivered or made available to DEQ within 3 working days of request. These inspection records and monitoring results must be maintained for at least 3 years after project completion. In addition, a copy of the ESCP and revisions must be retained on site and made available on request to the DEQ, Agent, or the local municipality. During inactive periods of greater than 7 consecutive calendar days, the ESCP must be retained by the permit registrant but does not need to be at the construction site.

J. Erosion On-Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
    1. Control movement of sediment and soil from temporary stockpiles of soil.
    2. Prevent development of ruts due to equipment and vehicular traffic.
    3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

K. Erosion Off-Site: Prevent erosion of soil and deposition of sediment on other properties due to construction activities for this project.
    1. Prevent windblown soil from leaving the project site.
    2. Prevent tracking of mud onto public roads outside site.
    3. Prevent mud and sediment from flowing onto sidewalks and pavements.
    4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

L. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures pump dry and remove deposited sediment after each storm.

M. Sedimentation of Waterways Off-Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

N. Open Water: Prevent standing water that could become stagnant.

O. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.03 SUBMITTALS

A. Product Data: For materials indicated in ESCP and additional materials included in ESCP revisions.

B. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wattles: Straw-filled tube of flexible netting.
   1. Straw must be certified weed free forage.
   2. Netting to consist of seamless, high density polyethylene and ethyl vinyl acetate and contain ultra-violet inhibitors.

B. Bio-filtration Bags: Bark or woodchip filled bag of flexible netting.
   1. Fill material shall be clean, 100 percent recycled wood or compost product.
   2. Bags shall be made of nylon mesh.

C. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; with the following properties:
   1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D 4751.
   2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D 4491.
   3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after 500 hours exposure.
   4. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D 4632.
   5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D 4632.
   6. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D 4533.
   7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

D. Silt Fence Posts: One of the following, minimum 4 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.
   2. Softwood, 4 by 4 inches in cross-section.
   3. Hardwood, 2 by 2 inches in cross-section.

E. Gravel: As called out on the details.

F. Inlet protection filter sack: as shown on plans.

G. Sediment curtains

H. Flocculants: Chemical used to aid settling of small particles.
   1. Product Manufacturers:
      a. Stormklear GelFloc
      b. Or approved equal.

I. Erosion Control Blankets: as shown on plans.

J. Compost Socks: Mixed yard debris compost-filled tube of synthetic or cotton fiber.

K. Concrete Washout Container: Temporary containment system for cementitious material wash-outs.
   1. Product Manufacturers:
      a. Eco-Pan
      b. Or approved equal.

L. Concrete Wash-out Pit: As shown on Plans.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.
   1. Width: As required; twenty (20) feet, minimum.
   2. Length: fifty (50) feet, minimum.
   3. Provide at each construction entrance from public right-of-way.
   4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences, wattles, or compost socks.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
   2. Space sediment barriers with the following maximum slope length upslope from barrier:
      a. Slope of Less Than 2 Percent: 100 feet.
      b. Slope Between 2 and 5 Percent: 75 feet.
      c. Slope Between 5 and 10 Percent: 50 feet.
      d. Slope Between 10 and 20 Percent: 25 feet.
      e. Slope Over 20 Percent: 15 feet.

D. Inlet Protection Filter Sack: Protect each inlet using the following measures:
   1. Woven fabric bag insert set beneath inlet grate.
   2. Bio-filtration bags blocking entire inlet face area.

E. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

F. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with polyethylene film, secured by placing soil or sand bags on outer edges.
   2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves; or, 6 inches of straw or hay;
      a. as approved by Owner's Representative.

G. Temporary Seeding: Use where temporary vegetated cover is required.

H. Concrete Wash-out Container: Use when there is not sufficient space for a traditional concrete wash-out pit.

I. Concrete Wash-out Pit: Size as required to handle estimated concrete usage.

3.04 INSTALLATION

A. Temporary Traffic-Bearing Aggregate Surface:
   1. Excavate minimum of 6 inches.
   2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
   3. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:
   1. Store and handle fabric in accordance with ASTM D 4873.
   2. Use nominal 36 inch high barriers with minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
   3. Install with top of fabric at nominal height and embedment as specified.
   4. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
   5. Fasten fabric to wood posts using one of the following:
      a. Integral pockets.
      b. Four 3/4 inch diameter, 1 inch long, 14 gage nails.
      c. Five 17-gage staples with 3/4 inch wide crown and 1/2 inch legs.
   6. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
   7. Wherever runoff will flow around end of barrier, provide temporary splash pad or other outlet protection.

C. Bio-Filter Bag:
   1. Install bags in continuous rows with ends butting tightly, with one bag at each end of row turned uphill.
   2. Anchor bags with at least two stakes per bag, into the ground.

D. Inlet Protection Filter Sack:
   1. Install per manufacturer's recommendations.

E. Wattles
   1. Install wattles in 3-5-inch minimum deep trench that is constructed along the contour, perpendicular to the slope or direction of flow.
   2. Embed wattle with a 1-inch by 1-inch hardwood stake every 4 lineal feet, driven at least 18 inches into the ground. A stake shall be placed within two feet of the end of the wattle.
   3. Adjacent rolls shall tightly abut.

F. Concrete Wash-out Container:
   1. Install per manufacturer's recommendations on level ground.

G. Concrete Wash-out Pit:
   1. Install as shown on Plans.

3.05 MAINTENANCE

A. Inspect preventive measures routinely (daily), within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:
   1. Promptly replace fabric that deteriorates unless need for fence has passed.
   2. Remove silt deposits that exceed one-third of the height of the fence.
   3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Bio-Filtration Bags:
   1. Promptly replace bags that fall apart or otherwise deteriorate unless need has passed.
   2. Remove silt deposits that exceed one-half of the height of the bags.

3. Repair bag rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Inlet Protection Filter Sacks
   1. Promptly replace sacks that are damaged or deteriorated unless the need has passed.
   2. Remove silt deposits that exceed the containment area of the sack.

F. Wattle Rows:
   1. Promptly replace wattles that fall apart or otherwise deteriorate unless need has passed.
   2. Remove silt deposits that exceed one-half of the height of the wattles.
   3. Repair wattles that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

G. Clean out temporary sediment control structures weekly and relocate soil on site.

H. Place sediment in appropriate locations on site; do not remove from site.

I. Concrete Wash-out Container: Properly call container provider to pick up pan when full and replace with empty pan or properly disopose of concrete waste material. Concrete waste to be recycled by container provider.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owners Representative.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 32 1216

ASPHALT PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cold milling of existing asphalt pavement.
   2. Hot-mix asphalt patching.
   3. Hot-mix asphalt paving.
   4. Hot-mix asphalt overlay.
   5. Pavement-marking paint.
   6. Pavement-marking thermoplastic material.

B. Related Requirements:
   1. Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, aggregate subbase and base courses, and aggregate pavement shoulders.

1.02 SUBMITTALS

A. Product Data: For each type of product. Include technical data and tested physical and performance properties.
   1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the work.
   2. Job-mix Designs: For each job mix proposed for the Work.

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Material Certificates: For each paving material.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Section 0744 of the 2018 Oregon Standard Specifications for Construction for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expect before time required for adequate cure, or if the following conditions are not met:
   1. Tack Coat: Minimum surface temperature of 60 deg F .
   2. Asphalt Base and Surface Course:

Dense Graded Mixes	Surface Temperature
Less than 2 inches	60 degrees F
2 inches – 2 1/2 inches	50 degrees F
Greater than 2 1/2 inches	40 degrees F

   3. If placing asphalt between March 15 and September 30, temperature may be lowered 5 degrees F.
   4. Do not use field burners or other devices to heat the pavement to the specified minimum temperature.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil based materials or 55 deg F for water-based materials, and not exceeding 95 deg F .

C. Thermoplastic Pavement-Markings: Proceed with pavement markings only on clean, dry surfaces, minimum ambient or surface temperature shall be 50 deg F.

PART 2 PRODUCTS

2.01 AGGREGATES

A. Conform to the requirements of 00744 of the 2015 Oregon Standard Specifications for Construction.

2.02 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.

B. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt.

2.03 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

C. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
   1. Color: As Indicated.

D. Thermoplastic Pavement Markings: Type B-HS Pre-formed, fused thermoplastic film conformed to the requirements of 00867 of the 2015 Oregon Standard Specifications for Construction.
   1. Color: As Indicated.

E. Wheel Stops: Precast, air-entrained concrete, 2500-psi (17.2 MPa) minimum compressive strength, 6 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
   1. Dowels: Galvanized steel, ¾ inch diameter, 10-inch minimum length.

2.04 MIXES

A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent or more than **30** percent by weight.
   1. Surface Course Limit: Recycled content no more than 30 percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
   1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
   2. Provide mixes conforming to section 00744 of the 2018 Oregon Standard Specifications for Construction.
   3. Base Course: Level 2, ½ dense, HMAC.
   4. Surface Course: Level 2, ½ dense, HMAC.

PART 3 EXECUTION

3.01 EXAMINATION

A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
   1. Mill to a depth of 1-1/2 inches.
   2. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.

B. If the cold-milled pavement surface will be exposed to traffic, sweep and clean prior to allowing traffic to use the roadway.

3.03 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
   1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply tack coat uniformly to vertical asphalt surfaces. Apply at a rate of 0.05 to 0.15 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Asphalt and sand seal edges where new asphalt concrete meets existing pavement.

3.04 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.05 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
   1. Spread mix at a minimum temperature of 250 deg F.
   2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

D. Provide adequate lighting to illuminate the paver and the roadway in front of and behind the paver during the period from 30 minutes after sunset to 30 minutes before sunrise, or as deemed necessary by the Engineer. Provide a minimum light level of 10 foot-candles as

measured on the paved surface at a distance of 16 feet from the front and back edge of the paver. Shield lighting from adjacent traffic and roadways as necessary.

3.06 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.07 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

H. Provide adequate lighting to illuminate each roller and the roadway in front of and behind the roller during the period from 30 minutes after sunset to 30 minutes before sunrise, or as deemed necessary by the Engineer. Provide a minimum light level of 10 foot-candles as measured on the paved surface at a distance of 60 feet from the front and back edge of each roller. Shield lighting from adjacent traffic and roadways as necessary.

I. Compaction to a specified density will not be required for thin pavements such as leveling, patches, or where the nominal compacted thickness of a course of asphalt concrete pavement will be less than 2 inches.

3.08 INSTALLATION TOLERANCES

A. Cold Milling: Test with a 12-foot (3.7 meter) straightedge furnished and operated by the Contractor, as directed. The variation from the top of the ridges from the testing edge of the straightedge, between any two ridge contact points, shall not exceed 1/4 inch .

B. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

C. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch.
   2. Surface Course: 1/8 inch.
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
   4. Difference between adjacent panels: 1/8 inch .

3.09 PAVEMENT MARKING

A. Do not apply pavement-marking paint or thermoplastic material until layout, colors and placement have been verified with architect.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils .

E. Install thermoplastic pavement markings as indicated on the drawings per the requirements of section 00850 and 00867 of the 2015 Oregon Standard Specifications for Construction.

3.10 WHEEL STOPS

A. Install wheel stops with dowels.

3.11 CORRECTION OF DEFECTS

A. Correct all defects in materials and work at no additional cost to the owner, as follows:
   1. Fouled Surfaces: Immediately repair, clean, and re-tack fouled surfaces that would prevent full bond between successive lifts of mixture.
   2. Boils, Slicks, and Oversized Material: Immediately remove and replace boils, slicks, and oversized materials with fresh mixture.
   3. Segregation: Take immediate corrective measures when segregation or non-uniform surface texture is occurring in the finished mat. If segregation continues to occur, stop production until a plan for providing uniform surface texture is approved by the Port.
   4. Roller Damage to the Surface: Immediately correct surface damage from rollers with additional fresh mixture or by other means approved by the owner.
   5. Longitudinal Joints: Take immediate corrective measures when open longitudinal joints are being constructed or when the elevation of the two sides of a longitudinal joint does not match. If problems with the longitudinal joint continue to occur, stop production until a plan for providing tight, equal elevation longitudinal joints is approved by the owner.
   6. Corrective Measures: Take immediate corrective measures when the specified compaction density is not being achieved.
   7. Other Defects: Remove and replace any HMAC that:
      a. Is loose, broken, or mixed with dirt.
      b. Visually shows too much or too little asphalt.
      c. Is defective in any way.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

B. Verify density by random testing of the compacted surface with calibrated nuclear gauges. Determine the density by averaging QC tests performed by a Certified Density Technician (CDT) with the nuclear gauge operated in the backscatter mode according to AASHTO T 335 at one random location for each 100 tons of asphalt concrete placed, but take no less than 10 tests per shift. Do not locate the center of a density test less than 1 foot from the panel edge. Calculate the Moving Average Maximum Density (MAMD) according to ODOT TM 305.

C. Replace and compact hot-mix asphalt where core tests were taken.

D. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 WASTE HANDLING

A. Except for material indicated to be recycled, remove excavated materials from Project Site and legally dispose of them in an EPA-approved landfill.

END OF SECTION

SECTION 32 1313

CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Driveways.
   2. Roadways.
   3. Parking lots.
   4. Curbs and gutters.
   5. Sidewalks.

1.02 SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Samples: For each exposed product and for each color and texture specified.

D. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
   1. Cementitious materials.
   2. Mineral Aggregate
   3. Steel reinforcement and reinforcement accessories.
   4. Fiber reinforcement
   5. Admixtures (including Color Pigments)
   6. Curing compounds
   7. Applied finish materials.
   8. Bonding agent or epoxy adhesive.
   9. Joint fillers.

F. Minutes of preinstallation conference.

G. Jointing and scoring layout shop drawing.

1.03 QUALITY ASSURANCE

A. Ready-Mix-Concrete 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."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301 unless otherwise indicated.

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Mockups: Cast mockups of full-size sections of concrete pavement (1 each type) to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
   1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete producer.
      d. Concrete pavement subcontractor.

1.04 PROJECT CONDITIONS

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

PART 2 PRODUCTS

2.01 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.02 STEEL REINFORCEMENT

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

C. Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars**;** zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

D. Tie bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

E. 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.
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, gray portland cement Type II
      a. Fly Ash: ASTM C 618, Class C.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   3. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

2.04 CONCRETE - INTEGRAL COLOR

1. Typical concrete mix per 2.03 with color admixture.
2. Integral Color Product: Davis Colors, Premium Color Group, or equal.
3. Color: Tile Red (approval by owner prior to installation)

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.06 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements.

2.07 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
   1. Compressive Strength (28 Days): 4000 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
   3. Slump Limit: 4 inches, plus or minus 1 inch.
   4. Air Content: 5-1/2 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.

B. Use a qualified testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

C. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

2.08 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When temperature is between 85 deg F 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

3.01 EXAMINATION AND PREPARATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading and elevation tolerances.

B. Proof-roll prepared subbase surface below **concrete paving** to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
   2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
   3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

C. Remove loose material from compacted subbase surface immediately before placing concrete.

D. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 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 24 hours after concrete placement.

B. After the forms have been set to correct grade, the grade shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with no less than 3 pins for each 10-foot section. A pin shall be placed at each side of every joint.

C. Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than 1/4 inch at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment.

D. The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

E. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.04 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints. If sufficient concrete is not available to finish the current panel, the Contractor shall remove the fresh concrete back to the nearest transverse joint.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Provide tie bars at sides of pavement strips where indicated.
3. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint or install plastic dowel sleeves per manufacturer's recommendations.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
1. Locate isolation joints at intervals of 200 feet, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Longitudinal Joints: A longitudinal joint shall be considered a joint parallel with the long dimension of the paving area.
1. Construction: Longitudinal construction joints necessary for lane construction shall be formed against suitable side forms (usually made of steel) with or without keyways, as indicated in the Drawings. Wooden forms may be used under special conditions, when approved by the Engineer. When the concrete is placed using slip-form pavers, the keyway shall be formed in the plastic concrete by means of preformed metal keyway liners which are inserted during the slip-form operations to form the female side of the key and which may be left in place. The dimensions of the keyway forms shall not vary more than plus or minus 1/4 inch from the dimensions indicated and shall not deviate more than plus or minus 1/4 inch from the mid-depth of the pavement. A male keyway may be used providing the keyway and edge tolerances are met. Where butt-type joints with dowels are designated, the dowels for this type shall be painted and greased. The edges of the joint shall be finished with a grooving tool or edging tool, and a space or slot shall be formed along the joint of the dimensions, as indicated, to receive the joint sealing material. Longitudinal construction joints shall be sawed to provide a groove at the top conforming to the details and dimensions indicated on the Drawings. Provisions shall be made for the installation of tie bars as noted on the Drawings.
2. Contraction or Weakened-Plane Type: the longitudinal groove formed or sawed in the top of the slab shall be installed where indicated on the Drawings. The groove shall be formed in the plastic concrete with suitable tools or material to obtain the width and depth specified, or it shall be sawed with approved equipment in the hardened concrete to the dimensions required. When the groove is formed in plastic concrete, it shall be true to line with not more than 1/4 inch variation in 10 feet; it shall be uniform in width and depth; and the sides of the groove shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The sawed groove shall be straight and of uniform width and depth. In either case, the groove shall be clean cut so that spalling will be avoided at intersections with transverse joints. Tie bars shall be installed across these joints where indicated on the Drawings.

E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness**,** to match jointing of existing adjacent concrete paving:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooved marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete once concrete has hardened sufficiently such that the cutting action will not tear, abrade, or otherwise damage the surface and before developing random contraction cracks. The sawing of any joints shall be discontinued or omitted if a crack occurs at or near the joint location before or during sawing. Concrete panels that have started cracking before or during the saw cutting of the joints shall be removed and replaced at no expense to the Owner.
   3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

F. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.05 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. 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.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, placing, and consolidating concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
   1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

I. 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.

J. Screed paving surface with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

O. 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 air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

P. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to 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. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 SPECIAL FINISHES

A. Monolithic Regular Exposed-Aggregate Finish: Expose coarse aggregate in pavement surfaces as follows:
   1. Immediately after float finishing, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
   2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
   3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
   4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
   5. Heavy Exposed areas: fully expose the basic rock and seed with the larger rounded rock. Exposure of the rounded seed rock shall be no more than ½ thickness of said rock. Seeded area should be about 10% to 15% of the total surface.

B. Seeded Glass Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on pavement surface. Tamp aggregate into plastic concrete, and float finish to entirely embed aggregate with mortar cover of 1/16 inch to 1/4 inch.
   1. Spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
   2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
   3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.

4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water 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-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
   2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

C. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a ¼ inch (6mm) radius. Repeat tooling of edges after applying surface finished. Eliminate tool marks on concrete surfaces.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to 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.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows.
   1. Moist 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. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   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.

3.09 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: ¼ inch .
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed ¼ inch.
   4. Joint Spacing: ½ inch .
   5. Contraction Joint Depth: Plus 1/4 inch, no minus.
   6. Joint Width: Plus 1/8 inch, no minus.

7. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
8. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
9. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
10. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. Yd or fraction thereof of each concrete mix placed each day.
      a. When frequency of testing will provide 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.
   2. 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 mix. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
   4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 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.

D. 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.

E. 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.

F. 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.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 REPAIRS AND PROTECTION

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 Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. 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.

END OF SECTION

SECTION 32 1723
PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Painted markings in play areas applied to concrete & asphalt surfaces.

B. Related Requirements:
   1. Section 099113 "Exterior Painting" for painting exterior concrete surfaces other than pavement markings.
   2. Section 099123 "Interior Painting" for painting interior concrete surfaces other than pavement markings.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to marking concrete surfaces including, but not limited to, the following:
      a. Asphalt-paving or concrete-surface aging period before application of pavement markings.
      b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.04 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.
   1. Pavement-marking paint, alkyd.
   2. Pavement-marking paint, solvent-borne.
   3. Pavement-marking paint, acrylic.
   4. Pavement-marking paint, latex.
   5. Glass beads.

B. Shop Drawings:
   1. Indicate pavement markings, colors, and dimensions to adjacent work.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Aexcel Inc.
   2. Approved equal.

B. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

C. Pavement-Marking Paint, Aexcel, Jet-Dry Acrylic Waterborne Traffic Marking Paint.
   1. Color: White

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.02 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner's Representative.

B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.03 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 32 1816.13
PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Organic loose-fill surfacing.
   2. Poured-in-Place rubber surfacing for sloped terraces.

1.03 DEFINITIONS

A. Definitions in ASTM F2223 apply to Work of this Section.

B. Critical Height: Standard measure of shock attenuation according to ASTM F2223; same as "critical fall height" in ASTM F1292. According to ASTM F1292, this approximates "the maximum fall height from which a life-threatening head injury would not be expected to occur."

C. SBR: Styrene-butadiene rubber.

D. Unitary Surfacing: A protective surfacing of one or more material components bound together to form a continuous surface; same as "unitary system" in ASTM F2223.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of protective surfacing.
   1. Include plans, sections, placement and penetration details, and attachment to substrates.
   2. Include accessories and edge terminations.
   3. Include fall heights and use zones for equipment and structures specified in Section 116800 "Play Field Equipment and Structures," coordinated with the critical heights for protective surfacing.

C. Samples for Verification: For each type of protective surfacing and exposed finish.
   1. Loose-Fill Surfacing: Minimum 1 quart.
   2. Edging: 6 inches long by full width and cross section.
   3. Stabilizing Mats: Minimum 12 by 12 inches
   4. Drainage/Separation Geotextile: Minimum 12 by 12 inches.
   5. Rubber Surfacing: 1 square foot of surfacing and attenuation pad.

D. Product Schedule: For protective surfacing.

E. Delegated Design: Playground equipment, final layout and shop drawings for items in scope of playground to be built as part of base bid (non owner-furnished, owner-installed scope) should include applicable drawings and engineering calculations by Oregon licensed professional, and IPEMA certified professional.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Material Certificates: For each type of loose-fill surfacing.

C. Product Certificates: For each type of unitary surfacing product.

D. Field quality-control reports.

E. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For playground protective surfacing to include in maintenance manuals.

1.07 QUALITY ASSURANCE

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

B. Synthetic Surfacing Vendor and Installer Qualifications: The synthetic poured-in-place rubber vendor and installer must be IPEMA Certified with no less than three completed playground installations. Installer must be competent in the installation of this material, including attachment of seams and proper installation of infill material prior to the start of rubber surfacing installation.

1.08 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of protective surfacing that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Reduction in impact attenuation as measured by reduction of critical fall height.
      b. Deterioration of protective surfacing and other materials beyond normal weathering.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain protective surfacing materials, including loose-fill accessories, from single source from single manufacturer.
   1. Provide geosynthetic accessories of each type from source recommended by manufacturer of protective surfacing materials.

2.02 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: Critical fall height tested according to ASTM F1292.

B. Accessibility Standard: Minimum surfacing performance according to ASTM F1951.

2.03 ORGANIC LOOSE-FILL SURFACING

A. Engineered Wood Fiber: ASTM F2075; containing no bark, leaves, twigs, or foreign or toxic materials; tested for accessibility according to ASTM F1951.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Lane Forest Products
      b. Rexius
      c. Allplay Systems LLC - Organic Loose-Fill Surfacing Woodcarpet Engineered Wood Fiber
   2. Uncompressed Material Depth: Not less than as required for critical height indicated.

2.04 SYNTHETIC POURED-IN-PLACE RUBBER PLAYGROUND SURFACING

A. Products:
   1. GT IMPAX Recycled Poured Rubber Surfacing
   2. Approved equal.

B. Vendor: Gametime

ADD 1

C. Color: Purple

D. Delegated Design: Playground surfacing to interface with base project contracted scope shall be coordinated with contractor; additional play equipment, mounting, footings and necessary design and engineering as part of Owner-Furnished, Owner-Installed (OFOI) scope.

2.05 GEOSYNTHETIC ACCESSORIES

A. Drainage/Separation Geotextile: Nonwoven, needle-punched geotextile, manufactured for drainage applications and made from polyolefins or polyesters; with the following minimum properties:
   1. Weight: 4 oz./sq. yd.; ASTM D5261.
   2. Water Flow Rate: 100 gpm/sq. ft. according to ASTM D4491.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for subgrade elevations, slope, and drainage and for other conditions affecting performance of the Work.
   1. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates to receive surfacing products according to protective surfacing manufacturer's written instructions.

3.03 INSTALLATION OF GEOSYNTHETIC ACCESSORIES

A. Install geosynthetic accessories before edging and according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions and in a manner that cannot become a tripping hazard.
   1. Drainage/Separation Geotextile: Completely cover area beneath protective surfacing, overlapping geotextile sides and edges a minimum of 8 inches with manufacturer's standard treatment for overlapping loosely laid seams.

3.04 INSTALLATION OF LOOSE-FILL SURFACING

A. Apply components of loose-fill surfacing according to manufacturer's written instructions to produce a uniform surface.

B. Loose Fill: Place loose-fill materials to required depth after installation of playground equipment support posts and foundations. Include manufacturer's recommended amount of additional material to offset natural compaction over time.

C. Grading: Uniformly grade loose fill to an even surface free from irregularities.

D. Finish Grading: Hand rake to a uniformly smooth finished surface and to required elevations.

3.05 INSTALLATION OF SYNTHETIC SURFACING

A General: Comply with manufacturer’s written installation instructions. Install playground surface system over area shown and, in a thickness, to meet critical heights of final equipment locations. Ensure the subgrade, drain rock and geosynthetic fabric is all in place to levels and compaction indicated prior to placing the Synthetic Surfacing.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Perform the following tests with the assistance of a factory-authorized service representative:
   1. Perform "Installed Surface Performance Test" according to ASTM F1292 for each protective surfacing type and thickness in each playground area.
   2. Perform installed-surface-performance tests at no less than one series of tests for each 1000 sq. ft. of each type and thickness of in-place protective surfacing or part thereof.

C. Playground protective surfacing will be considered defective if it does not pass tests.

D. Prepare test reports.

3.07 PROTECTION

A. Prevent traffic over surfacing for not less than 48 hours after installation.

END OF SECTION

SECTION 32 3113
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Chain-link fences and gates.
   2. Chain-link backstop system.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete"
   2. Section 08 71 01 "Door Hardware Schedule" for gate controls.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
   2. Review sequence of operation for each type of gate operator.
   3. Review coordination of interlocked equipment specified in this Section and elsewhere.
   4. Review required testing, inspecting, and certifying procedures.

1.04 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 the following:
      a. Fence and gate posts, rails, and fittings.
      b. Chain-link fabric, reinforcements, and attachments.
      c. Accessories: Privacy slats
      d. Gates and hardware.
      e. Gate operators, including operating instructions and motor characteristics.

B. Shop Drawings: For each type of fence and gate assembly.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include accessories, hardware, gate operation, and operational clearances.
   3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
   4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
   1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

E. Delegated-Design Submittal:
   1. For structural performance of chain-link fence and gate frameworks, backstop elements, including analysis data signed and sealed by the qualified professional engineer specializing in the associated work and registered in Oregon. responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For factory-authorized service representative.

B. Product Certificates: For each type of chain-link fence, operator, and gate.

C. Product Test Reports: For framework strength according to ASTM F1043, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

C. Mockups: Build mockups to set quality standards for fabrication and installation.
   1. Build mockup for typical chain-link fence and gate, including accessories.
      a. Size: 8-foot length of fence.

1.08 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.09 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to comply with performance requirements.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      c. Faulty operation of gate operators and controls.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
   1. Design Wind Load: Per Structural Engineer

C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.02 CHAIN LINK FENCING & GATES:

A. Materials:
   1. Posts, Rails, and Frames: ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 30 ksi.
   2. Wire Fabric: ASTM A392 zinc chain link fabric.
   3. Concrete: Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 2,500 psi strength at 28 days, 3-inch slump; 3/4-inch nominal size aggregate.

B. Components:
   1. Line Posts: 2.38-inch diameter.
   2. Corner and Terminal Posts: 2.88 inch.
   3. Gate Posts: 3.5-inch diameter.
   4. Top, Bottom, and Brace Rail: 1.66-inch diameter, plain end, sleeve coupled. (No Bottom Rails where indicated – Type 1A).
   5. Gate Frame: 1.66-inch diameter for welded fabrication.
   6. Fabric: 2-inch diamond mesh interwoven wire, 9 gauge, 0.1144-inch-thick, top selvage knuckle end closed, bottom selvage knuckle end closed. No protruding edges on selvage. This prevents someone from getting injured by bottom or top edges of fabric.
   7. Tension Wire: 6-gauge thick steel, single strand.
   8. Tie Wire: 11-gauge galvanized steel. No aluminum allowed.
   9. Base Plate: 1/4-inch plate steel, galvanized.

C. Accessories:
   1. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
   2. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners, and fittings; steel.
   3. Hinges: TruClose Series 3 or approved.
   4. Hardware for Single Swinging Gates: 180-degree hinges, 2 for gates up to 60 inches high, 3 for taller gates;
   5. Security hardware per Section 08 71 01

D. Finishes:
   1. Fencing: Components and Fabric: Powder coated components and Vinyl coated fabric over coating of 1.8 oz/sq. ft galvanizing.
      a. Color: Black
   2. Hardware: Powder coated over hot dip galvanized to weight required by ASTM A153/A153M.
      a. Color: Black
   3. Accessories: Same finish as framing.

2.03 BACKSTOP:

A. Materials: Match materials and finished per 2.02, Chain Link Fencing and Gates, design per manufacturer:

B. Products (Basis of Design):
   1. F-37 Backstop Kit, 20’ wide, 10’ wings, 6’ Canopy; supplied by Hoover Fence Company – www.hooverfence.com or equal.
   2. Match materials and fencing per 2.02
   3. Delegated design – provide shop drawings & engineering calculations per 1.04 E

2.04 FABRICATION:

A. Swing Gates:
   1. Fabricate frames of gates of same material and finish of adjoining fencing. Assemble gate frames by welding prior to galvanizing.

B. Hardware:
   1. Gate Hinges: See accessories section.
   2. Center gate stop and drop rod at double gates. Metal sleeve set in concrete for drop rod.
   3. Provision for Locks: Industrial drop rod type latches for pad lock, locks NIC.
   4. Install framework, fabric, accessories, and gates in accordance with ASTM F567.
   5. Place fabric on outside of posts and rails.
   6. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
   7. Line Post Footing Depth Below Finish Grade: ASTM F567.
   8. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

9. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
10. Provide top rail through line post tops and splice with 6-inch-long rail sleeves.
11. Install center brace rail on corner gate leaves.
12. Install bottom rail between posts when there is a high likelihood of students sitting against.
13. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
14. Position bottom of fabric 2 inches above finished grade (mow strip).
15. Fasten fabric to top and bottom rail, line posts, and braces with tie wire at maximum 15 inches on centers.
16. Attach fabric to all fence elements (posts, braces, tension rods and braces) with specified tie wire at 15 inches on center maximum spacing.
17. Do not attach the hinged side of gate to building wall; provide gate posts.
18. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
19. Hinges: TrueClose series 3 or approved.
20. Panic Hardware:
    a. If identified, coordinate with security hardware per Section 08 71 01

2.05 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.06 GROUNDING MATERIALS

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
   1. Connectors for Below-Grade Use: Exothermic welded type.
   2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
   1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.
   1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
      a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
      b. Concealed Concrete: Place top of concrete 2 inches below grade as indicated on Drawings to allow covering with surface material.
      c. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
      d. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at 96 inches o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
   1. Locate horizontal braces at mid height of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
   1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

H. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.
   1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

3.04 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.05 GROUNDING AND BONDING

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Fence and Gate Grounding:
   1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
   2. Install ground rods and connections at maximum intervals of 1500 feet.
   3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
   4. Ground fence on each side of gates and other fence openings.
      a. Bond metal gates to gate posts.
      b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
   1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
   2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

F. Connections:
   1. Make connections with clean, bare metal at points of contact.
   2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   4. Make above-grade ground connections with mechanical fasteners.
   5. Make below-grade ground connections with exothermic welds.
   6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

H. Comply with requirements in Section 26 41 13 "Lightning Protection for Structures."

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests.

B. Grounding Tests: Comply with requirements in Section 26 41 13 "Lightning Protection for Structures."

C. Prepare test reports.

3.07 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

SECTION 32 3119
DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative steel fences and gates.

B. Delegated Design: Sliding vehicle access gate.

C. Automatic gate operators.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM D523 - Standard Test Method for Specular Gloss; 2014 (Reapproved 2018).

D. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings; 2013 (Reapproved 2018).

E. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments; 2008, with Editorial Revision (2017).

F. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2016.

G. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) ; 1993 (Reapproved 2019).

H. ASTM D3359 - Standard Test Method for Rating Adhesion by Tape Test; 2017.

I. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates; 2016.

J. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016.

K. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing; 2018.

L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Design Calculations: For high wind load areas, provide calculations for fence panels and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.

D. Shop Drawings:
   1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

E. Manufacturer's Qualification Statement.

F. Manufacturer's Warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

C. Mock-Up: Build sample section of fence for review and approval prior to proceding with the balance of work of this section.
   1. Include 10-foot (3-m) length of fence complying with requirements.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.07 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide twenty year manufacturer warranty against cracking, peeling, chipping, blistering or corroding of the surface on all welded ornamental panels and posts under normal and intended usage.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Wind Loading:
   1. Wind Exposure Category: B
   2. Design WInd Speed: 105 mph

2.02 FENCES

A. Basis of Design: Ameristar Perimeter Security, USA; Montage Plus: www.ameristarfence.com
   1. Substitutions: See Section 01 6000 - Product Requirements.

B. General: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating.

C. Style:
   1. Rail Type: 3 rail.
      a. Bottom: 1 rail, stardard offset from base of panel
      b. Top: 2 rails
   2. Picket Style: "Majestic" (square top pickets die into top rail).

D. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
   1. Total Coating Thickness: 2 mils, minimum.
   2. Color: Black.

E. Coating Performance: Comply with general requirements of ASTM F2408.
   1. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
   2. Impact Resistance: ASTM D2794; 60 inch pounds.
   3. Weathering Resistance: ASTM D523, ASTM D822/D822M and ASTM D2244; less than 60 percent loss of gloss.

F. Steel: ASTM A653/A653M; tensile strength 45,000 psi, minimum.
   1. Hot-dip galvanized; ASTM A653/A653M, G60.
   2. 62 percent recycled steel, minimum.

G. Components:
   1. General: Wall thickness shown are minimum. Provide greater thicknesses if required to withstand loading.
   2. Standard posts: 2 1/2-inch by 2 1/2-inch, 12-gauge tubing.
   3. Pickets: 3/4-inch by 3/4-inch, 18-gauge tubing.
      a. Spacing: 4-inch standard airspace.
   4. Rails: 1 1/2-inch by 1 7/16-inch ribbed U channel, 14 gauge.
   5. Gate Posts: 4-inch by 4-inch, 1/4-inch wall thickness, minimum..

H. Swing Gates:
   1. Components:
      a. Fabricated of same materials as fence system.
         1) Gates with panics to have anti-reach plate appx 2' high, width of gate, 1/8" minimum thick plate.
         2) ¾" max opening mesh above and below panic hardware. Also place adjacent to gate if protection is needed from reaching around posts.
         3) Provide adequate mounting surface and enclosure for required security hardware specified.
      b. Provide adjustable diagonal bracing to prevent sag.
   2. Hardware:
      a. Hinges at single swing gates: TrueClose series 3, or approved.
      b. Hinges at double swing gates: As recommended by manufacturer for size and weight of gates.
      c. Finished to match gate components.
      d. Security Hardware: Complete system for panic hardware at all gate latches, including mounting plate, weatherproof surface mounted push bar, strike latch and lock box, pull handles and lock cylinders. Weld mounting plate to gate prior to powder coating.
      e. Strike: At each gate, provide metal angle stop the full height of the gate.
      f. Hold-Opens: At each gate, provide wall or post mounted hasp for locking gate in the open position.
      g. At Double Swing Gates: Provide locking drop cane on passive leaf and hasp for padlock to secure active leaf to passive one.
      h. See Section 08 7100 Door Hardware for additional information on required security hardware for gates.

I. Cantilevered Horizontal Sliding Gates:
   1. Delegated Design: Fabricator to design vehicle access gate.
      a. ASTM F1184, Class 1
      b. Size guide rails, vertical members and diagonal bracing to resist expected loading.
      c. Design picket and rail assembly to match balance of Decorative Metal Fencing.
      d. Roller support posts, concrete foundations, gate rollers and hardware required for complete, operation gate.
      e. Provide aluminum drive rail compatible with operator.
      f. Dimensions: See Drawings.

J. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.
   1. Tamper-proof security bolts.

K. Hinges: Finished to match fence components.
   1. Hinges: TrueClose series 3, or approved.

L. Fittings and Accessories:
   1. Post Caps: Flat

2.03 AUTOMATIC GATE OPERATORS

A. Operators: Factory-assembled, automatic, gate-operating system designed for gate size, type, weight, and frequency of use. Control system shall have characteristics suitable for Project conditions, with control stations, safety devices, and weatherproof enclosures.
   1. Basis of Design: HySecurity SlideDriver hydraulic slide gate operator: https://hysecurity.com/operators-accessories/slide-gate-operators/slidedriver/
   2. Operator design shall allow for removal of cover or motor without disturbing limit-switch adjustment and without affecting auxiliary emergency operation.
   3. Electronic components shall have built-in troubleshooting diagnostic feature.
   4. Unit shall possess following characteristics:
      a. Capacity:
         1) Motor: 2 hp
         2) Duty Cycle: Continuous
         3) Battery Backup: Up to 80 cycles after AC power loss.
         4) Temperature rating: Rating: -13 degrees F to 158 degrees F
         5) Rate of Travel: 1 foot per second, minimum.
         6) Chain-less, rigid drive rail operation, Class II.
      b. Controller:
         1) Access-controlled (card reader).
         2) Vehicle-detection loop (free exit).
         3) Entrapment Sensor
         4) Timer-to-close
         5) RS-232, RS-485 and USB ports.
         6) Connect to building access control system. Provide connections to wall-mounted card reader on secure side of adjacent wall.
         7) Provide Emergency Vehicle Access (Fire, Police, etc.)
      c. Safety:
         1) Minimum 6 ft dimension between access control device and entry-side face of vehicle gate.
         2) Photo-eye or edge sensor entrapment protection at all potential entrapment zones (1 open direction and 1 close direction, minimum), including gate backtravel zone per UL 325.
         3) Painted Metal Signs: "CAUTION AUTOMATIC GATE" and as required to satisfy UL 325.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. UL Standard: Manufacture and label gate operators according to UL 325.

D. Motors: Comply with NEMA MG 1.
   1. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
   2. Service Factor: 1.15.

2.04 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
   1. Construction layout and field engineering are specified in Section 01 73 00 "Execution."

3.03 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1.2 m).

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
      a. Exposed Concrete: Extend 2 inches (51 mm) above grade. Finish and slope top surface to drain water away from post.
      b. Concealed Concrete: Top 2 inches to allow covering with surface material. Slope top surface of concrete to drain water away from post.
   3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
   4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch (20 mm) larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
      a. Extend posts at least 5 inches (125 mm) into sleeve.
      b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
   5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch (20 mm) larger than outside diagonal dimension of post.
      a. Extend posts at least 5 inches (125 mm) into concrete.
      b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
   6. Space posts uniformly at 6 feet o.c

3.04 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary

3.05 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

C. When cutting rails immediately seal the exposed surfaces by:
   1. Removing metal shavings from cut area.
   2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.
   3. Apply two coats of custom finish spray paint matching fence color.

D. Install operator in accordance with manufacturer's instructions and in accordance with NFPA 70.

3.06 GROUNDING AND BONDING

A. Comply with Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:
   1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
      a. Gates and Other Fence Openings: Ground fence on each side of opening.
         1) Bond metal gates to gate posts.
         2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

F. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

H. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence, and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.07

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of

reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.09 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, and limit switches.
   1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware and other moving parts.

3.10 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

C. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.

D. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

3.11 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional 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. Briefly describe function, operation, and maintenance of each component.

3.12 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION 32 3119

SECTION 32 32 23
CONCRETE SEGMENTAL RETAINING WALL SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work consists of delegated design and engineering for furnishing and construction of an Anchor Diamond Pro Retaining Wall System in accordance with these specifications and in general conformity with the layout lines, grades, design, and dimensions shown on the plans.

B. Earthwork includes:
   1. Preparing Foundation Soil and Retained Soil to the lines and grades shown on the construction drawings and verified in shop drawings;
   2. Furnishing and installing Leveling Pad, Reinforced Fill (where required) and Low Permeability Soil (where required) to the lines and grades shown on the construction drawings; and,

C. Installation work includes:
   1. Furnishing and installing Diamond Pro Concrete Facing Units and Unit Fill to achieve the lines and grades shown on the construction drawings and verified in shop drawings.
   2. Furnishing and installing Geosynthetic Reinforcement and Separation Geotextile of the type, size, location and length as needed per wall system requirements.
   3. Furnishing and installing Subsurface Drainage System, including necessary fittings, of the type, size, and location per wall system requirements.

1.02 RELATED SECTIONS

A. Section 02300 – Earthwork

1.03 REFERENCES

A. American Association of State Highway Transportation Officials (AASHTO)
   1. AASHTO Standard Specifications for Highway Bridges
   2. AASHTO M 288 Geotextile Specifications for Highway Applications
   3. AASHTO M 252 Corrugated Polyethylene Drainage Pipe
   4. AASHTO National Transportation Product Evaluation Program (NTPEP)

B. American Society for Testing and Materials (ASTM)
   1. ASTM C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
   2. ASTM C1262 Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
   3. ASTM C1372 Standard Specification for Segmental Retaining Wall Units
   4. ASTM D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
   5. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/f3)(600 kN-m/m3)
   6. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil In Place by the Sand Cone Method
   7. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/f3)(2700 kN-m/m3)
   8. ASTM D2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
   9. ASTM D2922 Standard Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
   10. ASTM D3034 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer

pipe and Fittings
11. ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
12. ASTM D4491 Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method
13. ASTM D4595 Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
14. ASTM D4873 Standard Guide for Identification, Storage and Handling of Geosynthetics
15. ASTM D5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
16. ASTM D5262 Standard Test Method for Evaluating the Unconfined Tension Creep Behavior of Geosynthetics
17. ASTM D5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
18. ASTM D5818 Standard Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage
19. ASTM D6637 Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method
20. ASTM D6638 Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units
21. ASTM D6916 Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units
22. ASTM D6706 Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil
23. ASTM F405 Standard Specification for Corrugated Polyethylene (PE) Tubings and Fittings
24. ASTM G51 Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing

C. Federal Highway Administration
1. Samtani, Naresh C., Christopher, B., and Berg, R., “Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes”, Volumes 1 and 2, Federal Highway Administration Report Nos. FHWA-NHI-10-024 and FHWA-NHI-10-025, November 2009.
2. Elias, V., Fishman, K., Christopher, B., and Berg, R., “Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes”, Federal Highway Administration Report No. FHWA-NHI-09-087, November 2009.

D. National Concrete Masonry Association (NCMA)
1. NCMA Design Manual for Segmental Retaining Walls, Third Edition, 2010

1.04 DEFINITIONS

A. Segmental Retaining Wall (SRW) Units: Dry-stacked concrete masonry units used as the retaining wall fascia.

B. Reinforced Fill: Soil which is used as fill behind the SRW unit and within the reinforced soil mass (if applicable).

C. Unit Fill and Drainage Aggregate: Material used (if applicable) within, between, and directly behind the concrete retaining wall units.

D. Geotextile Separation Fabric: Material used for separation and filtration of dissimilar soil types.

E. Foundation Soil: Soil mass supporting the leveling pad and reinforced soil zone of the retaining wall system.

F. Retained Soil: The soil mass located behind the reinforced soil zone, either undisturbed native soils or compacted fill.

G. Leveling Pad: A level surface consisting of crushed stone, sand and gravel or unreinforced concrete placed to provide a working surface for placement of the SRW unit.

H. Geosynthetic Reinforcement: Polymeric material designed specifically to reinforce the soil mass.

I. Pre-fabricated Drainage Composite: three-dimensional geosynthetic drainage medium encapsulated in a geotextile filter, used to transport water.

J. Subsurface Drainage System: horizontal pipe encapsulated within drainage aggregate at or near the base of the reinforced soil to facilitate removal of water from the wall system.

K. Low Permeability Soil: Clay soil or low permeability geosynthetic used to prevent water percolation into the drainage zone and reinforced backfill behind the wall.

L. Global Stability: The general mass movement of a soil reinforced segmental retaining wall structure and adjacent soil mass.

M. Project Geotechnical Engineer: A registered engineer who provides site observations, recommendations for foundation support/global stability, and verifies soil shear strength parameters.

1.05 SUBMITTALS / CERTIFICATION

A. Product Data
   1. Product Data: Material description and installation instructions for each manufactured product specified
   2. Name and address of the production facility where the proposed facing units will be manufactured. All units shall be manufactured at the same facility.
   3. Notarized letter from the facing unit manufacturer stating that the units supplied for this project are manufactured in complete compliance with this specification. The letter shall state that the units shown in the attached test reports are representative samples of the plants normal mix design and regular production runs.
   4. Notarized letter from the reinforcement manufacturer stating that the geosynthetic reinforcement has been manufactured in complete compliance with the reinforcement manufacturer's current NTPEP report.

B. Samples:
   1. Contractor shall submit to the owner for approval, and retain for the balance of the project, a minimum of one SRW unit that represents the range of texture and color permitted.

C. Test Reports:
   1. Independent Laboratory reports indicating compressive strength, moisture absorption and freeze-thaw durability of the concrete retaining wall units from the proposed production facility.
   2. Independent test reports verifying the long-term design strength properties (creep, installation damage, and durability) and soil interaction properties of the geosynthetic reinforcement.
   3. Independent test reports verifying the connection capacity between the geosynthetic reinforcement and the concrete retaining wall units.

D. Wall Design Engineer Qualifications:
   1. Current insurance policy verifying professional liability and errors and omissions

insurance coverage for an aggregate and per claim limit of at least one million dollars ($1,000,000).
2. Notarized letter certifying the proposed retaining wall Design Engineer is a licensed professional engineer in the state of wall installation and has a minimum of 4 years and 200,000 square feet of retaining wall system design experience.

E. Retaining Wall Contractor Qualifications:
1. Notarized statement showing that the retaining wall contractor has installed a minimum of 100,000 square feet of segmental retaining walls.
2. The Retaining Wall Installer shall furnish five (5) project references of similar size and scope to this project including the wall(s) height and square footage. References shall include the contact information of Owner or General Contractor.

F. Retaining Wall Design:
1. Shop Drawings: One digitally signed set of the retaining wall system design, including wall elevation views, geosynthetic reinforcement layout, pertinent details, and drainage provisions. A registered professional engineer licensed in the state of wall installation shall sign and certify that the shop drawings are designed in accordance with the project civil plans and specifications.
2. Design Calculations: One digitally signed set of engineering design calculations prepared in accordance with the NCMA Design Manual for Segmental Retaining Walls, 3rd Edition or the AASHTO Standard Specifications for Highway Bridges (whichever is applicable). Analysis shall include Internal, External and Bearing Capacity Calculations and include the short term and long term loading conditions on the wall. A Global Stability analysis should be coordinated with the project geotechnical engineer and incorporated into the wall design.

G. Delegated-Design Submittal:
1. Provide a delegated submittal package comprised of drawings, details and calculations signed and sealed by an engineer specializing in the associated work and registered in Oregon. Submittals shall indicate full compliance with the system components outlined in in Part 2.

1.06 DELIVERY, STORAGE AND HANDLING

A. SRW Units and Accessories: Deliver, store, and handle materials in accordance with manufacturer's recommendations, in such a manner as to prevent damage. Check the materials upon delivery to assure that proper material has been received. Store SRW units above ground on wood pallets or blocking. Remove damaged or otherwise unsuitable material, when so determined, from the site.

B. Exposed faces of SRW units shall be relatively free of chips, cracks, stains, and other imperfections detracting from their appearance, when viewed from a distance of 20 feet under diffused lighting.

C. Prevent mud, wet cement, adhesives and similar materials that may harm appearance of SRW units, from coming in contact with system components.

D. Geosynthetics (including geosynthetic reinforcement, geotextile filter, pre-fabricated drainage composite) shall be delivered, stored, and handled in accordance with ASTM D4873.

1.07 EXTRA MATERIALS

A. Furnish Owner with 3 replacement SRW units identical to those installed on the Project.

PART 2 - PRODUCTS

2.01 MATERIALS

A. SRW Units: Anchor Diamond Pro Retaining Wall Units" as manufactured under license from Anchor Wall Systems.
   1. Physical Requirements
      a. Meet requirements of ASTM C1372, except the unit height dimensions shall not vary more than plus or minus 1/16 inch from that specified in the ASTM reference, not including textured face.
      b. Unit Face Area: Not less than 1.0 square foot.
      c. Color: Selected by the [Architect] [Engineer] [Owner] from manufacturer's full range of standard colors.
      d. Face Pattern Geometry: Straight
      e. Texture: Split Rock Face.
      f. Batter: Include an integral concrete shear connection flange/locator to provide a 1 inch setback for each wall course.

B. Geosynthetic Reinforcement: Polyester fiber geogrid or geotextile, or polypropylene woven geotextile, per wall system requirements for height and configuration.

C. Leveling Pad
   1. Aggregate Base: Crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

Sieve Size	Percent Passing
1 inch	100
No. 4	35 to 70
No. 40	10 to 35
No. 200	3 to 10

      a. Base Thickness: 6 inches (minimum compacted thickness).
   2. Concrete Base: Non-reinforced lean concrete base.
      a. Compressive Strength: 3,000 psi (maximum).
      b. Base Thickness: At least 2 inches.

D. Unit Fill and Drainage Aggregate: Clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	75 to 100
No. 4	0 to 60
No. 40	0 to 50
No. 200	0 to 5

E. Reinforced Fill: Soil free of organics and debris and consisting of either GP, GW, SP, SW, or SM type, classified in accordance with ASTM D2487 and the USCS classification system and meeting the following gradation as determined in accordance with ASTM D448:

Sieve Size	Percent Passing
1 inch	100
No. 4	20 to 100
No. 40	0 to 60
No. 200	0 to 35

1. Plasticity Index (PI) < 6 per ASTM D4318.
2. Maximum particle size for backfill is 1 inch unless field tests have been performed to evaluate potential strength reduction to the geosynthetic reinforcement due to damage during construction per ASTM D5818.
3. Unsuitable soils are organic soils and those soils classified as SC, CL, ML, CH, OH, MH, OL, or PT.

F. Low Permeability Soil: Clayey soil or other similar material which will prevent percolation into the drainage zone behind the wall.

G. Drainage Pipe: Perforated or slotted PVC or corrugated HDPE pipe manufactured in accordance with D3034 and/or ASTM F405. All connectors and fittings shall match the piping material.

H. Geotextile Separation Fabric: Geotextile Separation fabric shall be minimum 4.0 oz/sy, polypropylene, needle-punched nonwoven fabric.

I. Construction Adhesive: Exterior grade adhesive as recommended by the retaining wall unit manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prior to commencing work, the retaining wall contractor shall examine the areas and conditions under which the retaining wall system is to be erected, and notify the Owner's Representative in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Promptly notify the wall design engineer of site conditions which may affect wall performance, soil conditions observed other than those assumed, or other conditions that may require a reevaluation of the wall design.

C. Verify the location of existing structures and utilities prior to excavation.

3.02 PREPARATION

A. Ensure surrounding structures are protected from the effects of wall excavation.

B. Excavation support, if required, is the responsibility of the Contractor, including the stability of the excavation and its influence on adjacent properties and structures.

3.03 EXCAVATION

A. Excavate to the lines and grades shown on the Drawings and verified in shop drawings. Over-excavation not approved by the Engineer or Owner's representative will not be paid for by the Owner. Replacement of these soils with compacted fill and/or wall system components will be required at the Contractor's expense. Use care in excavating to prevent disturbance of the base beyond the lines shown.

3.04 FOUNDATION PREPARATION

A. Excavate foundation soil as required for footing or base dimension per system requirements.

B. The Project geotechnical engineer will examine foundation soil to ensure that the actual foundation soil strength meets or exceeds that indicated on the Drawings and verified in shop

drawings and engineering calcs. At the direction of the project geotechnical engineer, remove soil not meeting the required strength. Oversize resulting excavation sufficiently from the front of the block to the back of the reinforcement, and backfill with suitable compacted backfill soils.

C. The Project geotechnical engineer will determine if the foundation soils will require special treatment or correction to control total and differential settlement.

D. Fill over-excavated areas with suitable compacted backfill, as recommended by the Project geotechnical engineer.

3.05 LEVELING PAD PREPARATION

A. Place base materials to the depths and widths shown per shop drawings and engineering, upon undisturbed soils, or foundation soils prepared in accordance with Article 3.04.
    1. Extend the leveling pad laterally at least 6 inches in front and behind the lowermost SRW unit.
    2. Provide aggregate base compacted to 6 inches thick (minimum) or as shown on the drawings.
    3. The Contractor may at their option, provide a concrete leveling pad as specified in Subparagraph 2.01.C.2, in lieu of the aggregate base.
    4. Where a reinforced footing is required by local code official, place footing below frost depth.

B. Compact aggregate base material to provide a level, hard surface on which to place the first course of SRW units.

C. Prepare base materials to ensure complete contact with SRW units. Gaps are not allowed.

3.06 ERECTION

A. General: Erect SRW units in accordance with manufacturer's instructions and recommendations, and as specified herein.

B. Place first course of concrete wall units on the prepared base material. Check units for level and alignment. Maintain the same elevation at the top of each unit within each section of the base course.

C. Ensure that foundation units are in full contact with the leveling pad.

D. Place concrete wall units side-by-side for full length of wall alignment. Alignment may be done by using a string line measured from the back of the block. Gaps are not allowed between the foundation concrete wall units.

E. Place drainage aggregate between and directly behind the SRW. Fill any voids in SRW units with drainage aggregate. Provide a drainage zone behind the SRW units a minimum of 12 inches wide to within 8 inches of the final grade. Cap the backfill and drainage aggregate zone with separation fabric and then 8 inches of low permeability soil.

F. Install drainage pipe at the lowest elevation possible to maintain gravity flow of water to outside of the reinforced zone. Slope the main collection drainage pipe 2 percent (minimum) to provide gravity flow to the daylighted areas. Daylight the main collection drainage pipe through the face of the wall, and/or to an appropriate location away from the wall system at each low point or at 50 foot (maximum) intervals along the wall. Alternately, the drainage pipe can be connected to a storm sewer system at 50 foot (maximum) intervals.

G. Remove excess fill from top of SRW units and install next course. Ensure drainage aggregate and backfill are compacted before installation of next course.

H. Check each course for level and alignment. Adjust SRW units as necessary to maintain level and alignment prior to proceeding with each additional course.

I. Install each succeeding course. Backfill as each course is completed. Pull the SRW units forward until the locating surface of the SRW unit contacts the locating surface of the SRW units in the preceding course. Interlock wall segments that meet at corners by overlapping successive courses. Attach SRW units at exterior corners with adhesive specified.

J. Install geosynthetic reinforcement in accordance with geosynthetic manufacturer's recommendations and the shop drawings.
    1. Orient geosynthetic reinforcement with the highest strength axis perpendicular to the wall face.
    2. Prior to geosynthetic reinforcement placement, place the backfill and compact to the elevation of the top of the wall units at the elevation of the geosynthetic reinforcement.
    3. Place geosynthetic reinforcement at the elevations and to the lengths shown on shop drawings.
    4. Lay geosynthetic reinforcement horizontally on top of the SRW units and the compacted backfill soils. Place the geosynthetic reinforcement within one inch of the face of the SRW units. Place the next course of SRW units on top of the geosynthetic reinforcement.
    5. The geosynthetic reinforcement shall be in tension and free from wrinkles prior to placement of the backfill soils. Pull geosynthetic reinforcement hand-taut and secure in place with staples, stakes, or by hand-tensioning until the geosynthetic reinforcement is covered by 6 inches of loose fill.
    6. The geosynthetic reinforcements shall be continuous throughout their embedment lengths. Splices in the geosynthetic reinforcement strength direction are not allowed.
    7. Do not operate tracked construction equipment directly on the geosynthetic reinforcement. At least 6 inches of compacted backfill soil is required prior to operation of tracked vehicles over the geosynthetic reinforcement. Keep turning of tracked construction equipment to a minimum.
    8. Rubber-tired equipment may pass over the geosynthetic reinforcement at speeds of less than 10 miles per hour. Turning of rubber-tired equipment is not allowed on the geosynthetic reinforcement.

3.07 BACKFILL PLACEMENT

A. Place reinforced fill, spread and compact in a manner that will minimize slack in the reinforcement.

B. Place fill within the reinforced zone and compact in lifts not exceeding 6 inches (loose thickness) where hand-operated compaction equipment is used, and not exceeding 12 inches (loose thickness) where heavy, self-propelled compaction equipment is used.
    1. Only lightweight hand-operated compaction equipment is allowed within 3 feet of the back of the retaining wall units. If the specified compaction cannot be achieved within 3 feet of the back of the retaining wall units, replace the reinforced soil in this zone with drainage aggregate material.

C. Compaction testing shall be done in accordance with ASTM D1556 or ASTM D2922.

D. Minimum Compaction Requirements for Fill Placed in the Reinforced and Retained Zone.
    1. The minimum compaction requirement shall be determined by the project geotechnical engineer testing the compaction. At no time shall the soil compaction requirements be less than 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)] for the entire wall height.
    2. Utility Trench Backfill: Compact utility trench backfill in or below the reinforced soil zone to 98 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)], or as recommended by the Project

geotechnical engineer. If the height from the utility to finish grade is higher than 30 feet, increase compaction to 100 percent of the standard Proctor density [modified Proctor density].
    a. Utilities must be properly designed (by others) to withstand all forces from the retaining wall units, reinforced soil mass, and surcharge loads, if any.
3. Moisture Content: Within 2 percentage points of the optimum moisture content for all wall heights.
4. These specifications may be changed based on recommendations by the Project geotechnical engineer.
    a. If changes are required, the Contract Sum will be adjusted by written Change Order.

E. At the end of each day's operation, slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.
1. The General Contractor is responsible for ensuring that the finished site drainage is directed away from the retaining wall system.
2. In addition, the General Contractor is responsible for ensuring that surface water runoff from adjacent construction areas is not allowed to enter the retaining wall area of the construction site.

F. Refer to Article 3.10 for compaction testing.

3.08 CAP UNIT INSTALLATION

A. Apply adhesive to the top surface of the SRW unit below and place the cap unit into desired position.

B. Cut cap SRW units as necessary to obtain the proper fit.

C. Backfill and compact to top of SRW unit.

3.09 SITE CONSTRUCTION TOLERANCES

A. Site Construction Tolerance
1. Vertical Alignment: Plus or minus 1-1/2 inches over any 10-foot distance, with a maximum differential of 3 inches over the length of the wall.
2. Horizontal Location Control from Grading Plan
    a. Straight Lines: Plus or minus 1-1/2 inches over any 10-foot distance.
    b. Corner and Radius Locations: Plus or minus 12 inches.
    c. Curves and Serpentine Radii: Plus or minus 2 feet.
3. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter of the concrete retaining wall units.
4. Bulging: Plus or minus 1-1/4 inches over any 10-foot distance.

3.10 FIELD QUALITY CONTROL

A. Installer is responsible for quality control of installation of system components.

B. The Owner or General Contractor, at their expense, will retain a qualified professional to perform quality assurance checks of the installer's work.

C. Correct work which does not meet these specifications or the requirements shown on the Drawings at the installer's expense.

D. Perform compaction testing of the reinforced backfill placed and compacted in the reinforced backfill zone.

1. Testing Frequency
    a. One test for every 2 feet (vertical) of fill placed and compacted, for every 50 lineal feet of retaining wall.
    b. Vary compaction test locations to cover the entire area of the reinforced soil zone, including the area compacted by the hand-operated compaction equipment.

3.11 ADJUSTING AND CLEANING

A. Replace damaged SRW units with new units as the work progresses.

B. Remove debris caused by wall construction and leave adjacent paved areas broom clean.

END OF SECTION

SECTION 32 3300
SITE FURNISHINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
1. Bicycle Racks
2. Bench
3. Area Drain Cover
4. Skate Stop
5. Relocated Skateboard Rack
6. Relocated Peace Pole
7. Relocated Bench

B. Related Requirements:
1. Section 03 30 00 "Cast-in-Place Concrete" for installing pipe sleeves cast in concrete footings.
2. Section 31 20 00 "Earth Moving" for excavation for installing concrete footings.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For units with factory-applied finishes.

C. Product Schedule: For site furnishings.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings manufactured with preservative-treated wood.
1. Indicate type of preservative used and net amount of preservative retained.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.06 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. Trash Receptacle Inner Containers: two full-size units for each size indicated.

PART 2 - PRODUCTS

2.01 BICYCLE RACKS

A. Landscape Forms “Bola” – Stainless Steel, embed mount

2.02 BENCH

A. Landscape Forms “Neocombo” – Aluminum, surface mount

2.03 AREA DRAIN COVER

A. Neenah Foundry – Model “R-4550, Type Q”, Cast Iron, 15”x15” to fit Gibson Steel Mini Basin

2.04 SKATE STOP

A. Skatestoppers; Intellicept Model G012SS 316; Stainless Steel, drilled and epoxied after wall construction - http://www.skatestoppers.com/G-Stainless.html

2.05 SKATEBOARD RACK

A. Existing skateboard rack; salvage and reinstall in location noted, mount per manufacturer's recommendations.

2.06 RELOCATED PEACE POLE

A. Existing wood peace pole; salvage and reinstall in location noted w/ concrete footing

2.07 RELOCATED BENCH

A. Existing metal bench; salvage and reinstall in location noted; attached with SS hardware

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored and positioned at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION

SECTION 32 8400
PLANTING IRRIGATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
1. Piping.
2. Valves.
3. Transition fittings.
4. Miscellaneous piping specialties.
5. Sprinklers.
6. Drip irrigation systems.
7. Controllers and electrical control wiring connectors.
8. Boxes for irrigation equipment.

B. Related Sections:
1. Section 32 91 13 "Soil Preparation" for placement of planting soil.
2. Section 32 92 00 "Turf and Grasses" for turf and grass requirements.
3. Section 32 93 00 "Plants" for plant requirements.

1.03 DEFINITIONS

A. Lateral Line Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow; also called "laterals."

B. Controller: Programmable electronic device that operates automatic irrigation systems.

C. Drain Piping: Downstream from lateral-piping drain valves. Piping is not under pressure.

D. ET Controllers: EvapoTranspiration Controllers. Irrigation controllers which use some method of weather-based adjustment of irrigation. These adjusting methods include use of historical monthly averages of ET; broadcasting of ET measurements; or use of on-site sensors to track ET.

E. Flow: The volume of water moving over time through a system as measured in gallons per minute (gpm).

F. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

G. Mainline Piping: Pressurized pipe that is downstream from point of connection that feeds into remote control valves; also called "mainline" or "main."

H. Point of Connection: Place where the irrigation system is connected to a water supply; also referred to and abbreviated as "POC."

I. Water Pressure: Force of water exerted over a given area measured in psi.

J. Manual Valve: Manually operated device used for controlling water through pipes.

K. Remote Control Valve: Valve that is activated automatically and regulates water to an irrigation zone; also called "automatic control valve" or "control valve."

1.04 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic remote-control valves.

B. Location of Sprinklers and Specialties: Design location, as indicated on the Drawings, is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Irrigation Pressure Report: Field verify static water pressure at irrigation point-of-connection meets minimum system operating design pressure. Notify Owner's Representative if there is a discrepancy.

1.06 INFORMATIONAL SUBMITTALS

A. Record Copy Drawings: During the irrigation system installation, indicate field changes in red line on a printed irrigation plan. This drawing shall be labeled "Record Copy," and shall be made available for review. The status of the record copy drawing must correlate directly with the percentage of work complete described in the Contractor's Pay Request and may be used as a guide when approving payments.

B. Qualification Data: For qualified Installer.

C. Qualification Data – Submit name of company and individual providing controller and 3D Hybrid Assembly.

D. Qualification Data – Submit name of company and individual providing pulse transmitter, communication accessories and Maxicom software programming.

E. Zoning Chart: Show each irrigation zone and its control valve.

F. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

G. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinklers, controllers, and remote-control valves to include in operation and maintenance manuals. Submit three copies of the following:
   1. Catalog product data "cut sheets" of all irrigation products installed.
   2. Contractor's name, address, email, and telephone number.
   3. The duration of the Guarantee Period.
   4. The name and address of the local manufacturer's representative.
   5. List and description of routine maintenance procedures, including winterization, start-up, and recommended watering times for each zone.
   6. Troubleshooting guide.

B. Upon completion of the Work of this section and as a condition of its acceptance; submit to the Owner's Representative the following:
   1. As-Built Drawings: Submit three prints and one reproducible file of as-built drawings. As-built drawings shall clearly show all original components of the Record Copy and all changes documented in the Record Copy. Main lines shall be positively located by a minimum of two dimensions each from fixed reference points. Additional items located: branch lines, head locations, wire paths, ground rod locations, zone flow values as tested during commissioning, drain valves, valve boxes, and valve markers and other buried equipment. In addition, the following information shall be included for all Drip or Low Volume Irrigation systems:
      a. Pop-up zone indictor location.
      b. Air vacuum relief and flush valve locations.

C. Controller Reference Chart: Submit one chart for each controller installed on site showing the area covered by each sprinkler zone. The chart shall be a reduced copy of the as-built drawings,

color coded to differentiate zone areas, sized to fit the controller door, and hermetically sealed between 20 mil. plastic sheets.

D. 4J Google Map: Append / Update 4J Google Map and submit to Owner's Representative. Request map sharing and editing privileges from 4J representative.

E. Supplemental Equipment: Submit two key copies for each of the following: quick coupling valves, quick coupling valve lids, valve markers, manual drain valves, valve boxes, and controller cabinets to the Owner's Representative.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers that include a qualified professional landscape installer with a valid Oregon landscape professional license for irrigation, whose work has resulted in successful establishment of similar irrigation installations.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Proprietary items shown on the Drawings and specified in this section are shown to establish standards of quality, utility, design, and function. Equivalent units by other manufacturers (substitutions) will be considered provided they are similar in characteristics. They shall be substituted only if approved by the Owner's Representative.

D. All local, municipal, and state laws and rules and regulations governing or relating to any portion of this Work are incorporated into and made a part of these specifications and the Contractor shall carry out their provisions. Information contained within this specification shall not be construed to conflict with the above rules, regulations, or requirements.

E. Controller and Maxicom component, including network communication shall be assembled and programmed by a certified factory technician for both Tucor and Rain Bird.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging, bending, and from physical damage.

C. Store and protect all equipment and appurtenances from adverse weather conditions and physical damage.

D. Handle all components as directed by the manufacturer's written instructions. Damage from transportation or other handling of materials shall be the responsibility of the Contractor.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
   1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of water service.
   2. Do not proceed with interruption of water service without Owner's Representative's written permission.

B. Site Inspection: Insect the site prior to construction and verify the extent of the work required. Commencement of construction designates acceptance of the site condition. Obtain approval to access system components for inspection prior to commencement of construction.

C. Verify the locations of all existing utilities, structures, and services before commencing Work. The location of utilities, structures and services shown on these plans are approximate only. Any discrepancies between the Drawings and the actual field conditions shall be reported to the Owner's Representative immediately.

PART 2 - PRODUCTS

2.01 GENERAL

A. All irrigation materials not specifically described or otherwise incidental to a complete, functioning irrigation system, shall be new and of working condition and approved of prior to installation.

2.02 PIPES, FITTINGS, AND TUBES

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Mainlines:
   1. PVC Pipe: ASTM D1785, PVC 1120 compound, Schedule 40.
      a. PVC Socket Fittings: ASTM D2466, Schedule 40.
      b. PVC Threaded Fittings: ASTM D2464, Schedule 80.
      c. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.
   2. PVC Pipe Pressure Rated: ASTM D2241, PVC 1120 compound, Class and SDR as indicated on Drawings.
      a. PVC Socket Fittings: ASTM D2467, Schedule 80.
      b. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

C. Lateral Lines:
   1. PVC Pipe: ASTM D1785, PVC 1120 compound, Schedule 40.
      a. PVC Socket Fittings: ASTM D2467, Schedule 80.
      b. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

D. Poly-Pipe: Flexible polyethylene swing pipe, UV resistant, sized according to manufacturer's sprinkler head and fitting requirements.

E. UV Resistant Pipe: PVC pipes at above-ground conditions as indicated on Drawings.
   1. PVC Pipe: ASTM D1784, PVC1120 compound, Type 1, Grade 1, Schedule 40.

F. Sleeves:
   1. PVC Pipe: ASTM D1785, PVC 1120 compound, Schedule 40.

G. Miscellaneous Fittings:
   1. Risers and Nipples: ASTM D2464 and ASTM D1785, PVC Schedule 80 with threaded ends.
   2. Fittings for PVC Pipe: ASTM D 2466, Schedule 80.
   3. Fittings for PVC Pipe Pressure Rated: ASTM D2467, Schedule 80.
      a. PVC Socket Fittings: ASTM 2467, Schedule 80.
      b. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.
   4. Swing Joint: Swing Joint Assembly Pipe and Fittings: Double swing joint risers as detailed. Swing-Pipe, snap, and "Funny pipe" risers not acceptable .
      a. Lasco model number G132-212 with 18" lay length, MIPT by MIPT, schedule 80, or approved equal.
   5. Minimum 1-inch diameter size and properly sized for associated irrigation heads and not increase water velocity through fittings above 5' per second.

H. Dripline Tubing:
   1. Products: Subject to compliance with requirements, provide one of the following:
      1) Netafim Techline CV series per plans.
      2) Approved equal.
   2. Description: Flexible polyethylene tubing, inline emitters, pressure-compensating, for use in subsurface drip irrigation.

I. Blank Polyethylene Tubing: Blank polyethylene, commercial grade, flexible, kink-free, thick-walled, UV resistant, black in color, sized as indicated on Drawings; for riser or distribution purposes.

2.03 PIPING JOINING MATERIALS

A. Solvent Cements for Joining PVC Piping: ASTM D2564, fast setting, high strength, low VOC. Include primer according to ASTM F656.

B. Teflon Tape for PVC Threaded Ends: PTFE tape, 3 mil minimum thickness.

C. Sealant for PVC Threaded Ends: Non-PTFE based, soft setting, slow drying, low VOC, lead free, safe for potable water systems, UL classified. Sealant material shall be safe and non-degrading to use with adjoining PVC materials.
   1. Products: Subject to compliance with requirements, provide the following:
      a. RectorSeal No. 5.
      b. Approved equal.

2.04 MANUAL VALVES

A. Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Crane; a Crane brand.
      c. Hammond Valve.
      d. Jenkins Valves; a Crane brand.
      e. KITZ Corporation.
      f. Milwaukee Valve Company.
      g. NIBCO INC.
      h. Powell Valves.
      i. WATTS.
      j. Zurn Industries, LLC.
   2. Description:
      a. Standard: MSS SP-80.
      b. Class: 125.
      c. CWP Rating: 200 psig.
      d. Body Material: ASTM B62, with integral seat and screw-in bonnet.
      e. Ends: Threaded.
      f. Stem: Bronze, rising stem and non-rising stem as indicated on Drawings.
      g. Disc: Solid wedge; bronze.
      h. Packing: Asbestos free.
      i. Handwheel: Malleable iron, bronze, or aluminum; rotary handle or cross-handle as indicated on Drawings.
   3. Gate Valve Keys: Standard operating keys as provided for drain valves.

B. Angle Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane; a Crane brand.
      b. Jenkins Valves; a Crane brand.
      c. Milwaukee Valve Company.
      d. NIBCO INC.
   2. Description:
      a. Size: 3/4-inch minimum size.
      b. Standard: MSS SP-80.
      c. Class: 125.
      d. CWP Rating: 200 psig.
      e. Body Material: Bronze, ASTM B62, with integral seat and screw-in or union bonnet.
      f. Ends: Threaded.

g. Stem: Bronze, rising stem.
h. Disc: PTFE.
i. Packing: Asbestos free.
j. Handwheel: Cross handle; malleable iron, bronze, or aluminum.

3. Drain Valve Keys: Three standard operating keys, 30-inch minimum length, fitted to operate valve.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Apollo Flow Controls; Conbraco Industries, Inc.
   c. Crane; a Crane brand.
   d. Hammond Valve.
   e. Lance Valves.
   f. Legend Valve & Fitting, Inc.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Red-White Valve Corp.
   j. WATTS.
   k. Zurn Industries, LLC.
2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Bronze.
   i. Ball: Chrome-plated brass or stainless steel.
   j. Port: Full or regular, but not reduced.
   k. Handle: Lever style.

D. Globe Valves: Bronze, threaded ends, non-rising stem.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Crane; a Crane brand.
   c. Hammond Valve.
   d. Jenkins Valves; a Crane brand.
   e. KITZ Corporation.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Powell Valves.
   i. WATTS.
   j. Zurn Industries, LLC.
2. Description:
   a. Standard: MSS SP-80.
   b. Class: 125.
   c. CWP Rating: 200 psig.
   d. Body Material: ASTM B62, with integral seat and screw-in bonnet.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron, bronze, or aluminum.

2.05 PRESSURE-REDUCING VALVES

A. Water Regulators:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Flow Controls; Conbraco Industries, Inc.
      b. Cash Acme, A Division of Reliance Worldwide Corporation.
      c. Honeywell.
      d. WATTS.
      e. Zurn Industries, LLC.
   2. Description:
      a. Standard: ASSE 1003.
      b. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
      c. Pressure Rating: Initial pressure of 150 psig.
      d. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.06 CONTROL VALVES

A. Remote Control Valves: As indicated on the drawings.

B. Master Valve: Bermad 110 Series

2.07 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.

2.08 SPRINKLERS

A. General Requirements: ABS plastic body material, pressure compensating devices, integral check valve body option at low points, designed for uniform coverage over entire spray area indicated at available water pressure. Manufacturer, product, and sprinkler type as indicated on Drawings

B. Pop-up Riser Heights: As indicated on Drawings.

C. Special Requirements: Bodies shall include an integral check valve body option for sprinklers installed at low points of system.

2.09 QUICK COUPLERS

A. Products: Subject to compliance with requirements, provide the following:
   1. Rain Bird Corporation; 44LRC.
   2. Approved equal.

B. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
   1. Locking-Top Option: Vandal-resistant locking feature. Include two matching key(s).

2.10 DRIP IRRIGATION

A. Application Pressure Regulators: Brass or plastic housing, NPS 3/4, with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig.

B. Inline Wye Filter: Brass or plastic housing as required by manufacturer, with corrosion-resistant internal parts; 200 mesh screen size or as required by manufacturer, 150 psi max rating, of size and capacity required for devices downstream from unit.

C. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

D. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

2.11 ELECTRICAL WIRE AND CONNECTORS

A. Controller Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial. ASIC Guideline 102-2004; between power source and controller.
   1. Feeder-Circuit Cables: No. 12 AWG minimum, between power source and controllers.
   2. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
   3. Valve Wires: 2-Wire Cable, No. 14 AWG minimum, double-jacketed with outer layer encased in HDPE material, insulated, wire type selection according to manufacturer requirements, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jacket color per manufacturer requirements.
   4. Waterproof Wire Connectors: 3M-DBY or approved equal.

2.12 CONTROLLERS

A. Products: As shown on Drawings

2.13 TWO WIRE DECODERS / SENSORS

A. Valve Decoder: Tucor 3D-050

B. Sensor Decoder: Tucor 3DSD-100

2.14 TWO WIRE PATH / SURGE PROTECTION

A. Surge Protector: Tucor SP-100

2.15 IRRIGATION EQUIPMENT VALVE BOXES

A. Valve Boxes:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Carson / Old Castle.
      b. Rain Bird Corporation.
      c. Approved equal.
   2. Description: Box and overlapping lid with locking mechanism, open bottom, and openings slots for piping; designed for installing flush with grade.
      a. Size: As required for equipment operation and as indicated on Drawings.
      b. Shape: As indicated on Drawings.
      c. Lid: Black color, HDPE with UV inhibitors.
      d. Box Enclosure: Black color, HDPE with UV inhibitors.
         1) Lettering: " IRRIGATION."

B. Polymer-Concrete Valve Boxes:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Armorcast Products Company.
      b. Christy Concrete Products.
      c. Oldcastle Enclosure Solutions.
      d. Approved equal.
   2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
      a. Size: As required for valves and service and as indicated on Drawings.
      b. Shape: Rectangular.
      c. Sidewall Material: Polymer concrete with lateral and vertical sidewall design loading of 5000 lb. minimum over 10 by 10 inches square.
      d. Cover Material: Polymer concrete with cover design loading of 5000 lb. minimum over 10 by 10 inches square.
         1) Lettering: " IRRIGATION."

2.16 MISCELLANEOUS PRODUCTS

A. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

B. Flow Meter / Sensor: FloMec; QS-200 or approved equal. The flow meter shall be directly connected to the controller using Rain Bird / Maxicom recommended communication cable.

C. Pulse Transmitter: Rain Bird PT 322

D. Ethernet Device Server / Communication for Maxicom: Rain Bird PT RBDS-SEMET

E. Concrete: Commercial grade concrete mix, compressive strength not less than 3,000 psi at 28 days.

F. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored according to APWA "Uniform Color Code." Specified in Section 31 20 00 "Earth Moving."

G. Tracer Wire: 12-gauge (AWG) stranded solid copper or copper clad steel reinforced, 45-mil thickness high molecular weight polyethylene insulation; detectable by metal detector when wire is buried up to 30 inches deep, UL rated for 140 degrees F; colored according to APWA "Uniform Color Code.".

PART 3 - EXECUTION

3.01 GENERAL

A. Irrigation layout and equipment as indicated on Drawings may be represented schematically and require field adjustment. Do not install any irrigation equipment or pipes if presented with obstructions, grade differences, access issues, or safety problems. Contact the Owner's Representative with any issues anticipated or encountered immediately.

B. Prior to conducting any Work of the section, inspect all previously installed work and that it is complete and functional for the operation of the irrigation system and its components.

C. Installation of any irrigation piping or equipment that connects to potable water sources shall prevent cross connection in accordance with pertinent local jurisdictional code and state law. Refer to "Backflow Prevention Device Installation" Article.

D. Maintain the performance and proper operation of the existing irrigation system the addition of the proposed irrigation system. The proposed irrigation equipment shall be functionally integrated into the existing equipment as to function as one complete system.

E. Maintain the site free of trash and construction debris. Trash and debris shall be removed from trenching and general excavation prior to backfilling. Soil contaminated by solvents, pipe shavings, or materials that cannot be easily separated shall be excavated out and properly removed from site.

F. Repair any planting soils or subgrade that has been compacted, disturbed, or degraded during irrigation system installation.

G. Provide grounding for all irrigation equipment according to manufacturer's recommendation.

H. Network communication devices and Maxicom software shall be programmed and installed by Rick Wagner at Waterwise Northwest (rick@waterwisenorthwest.com) 503-381-6282.

3.02 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.

C. Drain Pockets: Excavate and backfill with drainage backfill, to 12 inches below grade or as indicated on Drawings.

D. Provide minimum cover over top of underground piping according to the following:
   1. Irrigation Main Piping: Minimum depth of 24 Inches below finished grade, or not less than 18 inches below average local frost depth, whichever is deeper.
   2. Circuit Piping: 12 inches.
   3. Drain Piping: 12 inches.
   4. Sleeves: 24 inches.

3.03 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Owner's Representative approval before excavation.

3.04 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.

H. Lay piping on solid subbase, uniformly sloped without humps or depressions.

I. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

J. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.

K. Install piping in sleeves under parking lots, roadways, and sidewalks.

L. Install sleeves with socket fittings, and solvent-cemented joints.

3.05 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds. Do not use solvent cement on threaded joints.

D. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.

2. PVC Pressure Piping: Join schedule number, ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
3. PVC Nonpressure Piping: Join according to ASTM D2855.

3.06 CONCRETE THRUST BLOCK INSTALLATION

A. Provide concrete thrust blocks for all mainlines 3 inches and larger. Install in locations where mainline changes direction at all elbows, tees, and where the mainline piping ends. Pour concrete against pipe laid in firm soil with at least one cubic foot of concrete and generally form concrete thrust block in shape as indicated on Drawings.

B. Thrust blocks shall cure for a minimum of 5 days prior to mainline pressure test.

3.07 VALVE INSTALLATION

A. General Placement: Equipment and valve box locations shall installed in a manner as to not interrupt plant massing or groups, hedge lines, or otherwise alter the character of the proposed plantings.
1. Place valves and valve boxes in low growing ground cover areas offset from adjacent paving by a minimum of two times the specified ground cover spacing unless indicated otherwise.
2. In areas where valves or valve boxes may be readily visible, verify location with Owner's Representative prior to installation.
3. Provide valve box supports, filter fabric, and drainage backfill as indicated on Drawings.

B. Throttling Valves: Install in underground piping in boxes for automatic control valves.

C. Remote Control Valves: Install in valve boxes as indicated on Drawings and according to manufacturer instructions

D. Drain Valves: Install in underground piping in boxes for automatic control valves.

E. Quick Coupling Valves: Install in valve boxes as indicated on Drawings and according to manufacturer instructions

F. Two-Wire Decoders: Install all decoders in valve boxes connected to control wire per manufacturer's recommendation.

3.08 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights and as indicated on Drawings.

C. Locate part-circle sprinklers to maintain a minimum distance of 3 inches from walls and 1 inch from other boundaries unless otherwise indicated.

D. Install sprinklers with internal check valve at low elevation points of each zone to prevent low head drainage issues. Install

E. Install inline check valves on lateral pipes that have more than 12 feet in elevation change from the control valve to lowest head.

3.09 DRIP IRRIGATION INSTALLATION

A. Landscape Dripline: Install dripline tubing with in-line emitters indicated on Drawings prior to installation of mulch. Stake in place according to manufacturer instructions, or as shown on drawings, whichever is lesser. Layout tubing rows in a triangular pattern as detailed on drawings.
1. Cap ends as instructed by manufacturer. Place end caps at surface or valve box to facilitate flushing.
2. On slopes, place tubing uphill from the plant material, where feasible, with dripline tubing installed with the contours and according to manufacturer instructions.
3. Do not install tubing in conditions cold enough to restrict uncoiling. Do not pull tubing. Allow for expansion and contraction.

4. Install slip and barbed fittings for drip system components according to manufacturer instructions.

B. Install application pressure regulators and filter units in piping near device being protected, and in control-valve boxes.

C. Install air relief valves and vacuum relief valves in piping, and in control-valve boxes.

D. All drip zones shall be water tested in presence of Owner's Representative prior to burial.

3.10 SYSTEM FLUSHING AND PRESSURE TEST

A. System Flushing: After piping, risers, backflow prevention devices and valves are installed but prior to irrigation head installation; flush dirt and debris from piping under full water head.
1. Maintain flushing for five minutes or until water flows clearly.
2. Cap risers immediately after flushing.

B. Hydrostatic Test: Perform hydrostatic pressure test after system flushing and after piping, risers, backflow prevention devices and valves are installed but prior to backfilling.
1. Mainlines: Purge all main lines of air and test with static water pressure of at least 125 psi for 60 minutes. Test with one pressure gauge installed on the line. Lines showing loss of pressure exceeding 5 psi at the end of the specified test period will be rejected. Correct rejected installations and retest for leaks.
2. Lateral Lines: Purge all lateral lines of air and test under operating line pressures with risers capped and drain valves closed. Maintain operating line pressures for 30 minutes through open valves and pressure regulating devices. Lines showing leaks when visually inspected at the end of the specified test periods will be rejected. Correct and retest lateral line installations that have been rejected.
3. Do not backfill trenches until the piping has been inspected and tested. Obtain Owner's Representative's approval prior to backfilling.

3.11 CONTROLLER AND ENCLOSURE INSTALLATION

A. Coordinate location of power source to controller according to the National Electronic Code and state and local laws.

B. Equipment Mounting: Install interior controllers on wall.
1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Electrical Grounding: Provide grounding according to manufacturer specifications and according to ASIC guidelines.

3.12 ELECTRICAL WIRING INSTALLATION

A. Control Wire, General: Install two-wire cabling and decoders to remote control valves. Provide consistent wire jacket colors throughout site system installation; colors shall be typical of irrigation systems. Wire path shall not make a complete loop. Each segment shall utilize differing wire colors. All wiring shall meet Rain Bird / Maxicom standards.
1. Provide conductors of size not smaller than recommended by controller manufacturer.
2. Bundle wiring at 15-foot intervals, or as necessary, with standard electrical cable ties.
3. Snake wire in trench to provide additional slack along the wire run.
4. Wire path for decoders must not be a continuous looped circuit. Provide wiring diagram to Owner's Representative for approval prior to commencing work.
5. Two wire path shall be grounded every 200 linear feet and at terminal end of each wire path.

B. Run valve wires from controller to remote control valves in electrical conduit, from the bottom of controller to outside of enclosure as indicated on Drawings in accordance with state and local requirements.

C. Wiring in Planting Area Trenches: Install control wires in same trench as irrigation piping and at least 2 inches below the bottom-most irrigation pipe. When necessary to run wire separate from the irrigation pipe, place the wire under detectable warning tape.

D. Wiring Under Paving: Install all control wires in separate sleeve under paved areas within the same trench as irrigation piping, where feasible. In locations that require a separate trench for wiring; provide a minimum cover of 18 inches to top of sleeve.

E. Splices: Utilize waterproof splice connectors as installed according to manufacturer's instructions. Provide coils of at least 30 inches minimum length, or as indicated. Splices not occurring within remote control valve boxes shall be installed in a separate valve box.

F. Spare Wires: Run additional control wire from controller to furthest remote control valve at each leg of mainline. Provide 18 inches of looped control wire at each end and label wiring on each side "Spare Wire." Spare wiring to remain unconnected in controller enclosure and neatly bundled in valve box.

3.13 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 13 "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

3.14 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
   1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Detectable Warning Tapes and Tracer Wire: Arrange for installation of continuous, underground, detectable warning tapes and tracer wire over underground piping during backfilling of trenches. See Section 31 20 00 "Earth Moving."

3.15 FIELD QUALITY CONTROL TESTING

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Any irrigation product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.16 STARTUP SERVICE

A. Startup service shall be provided by Rick Wagner at Waterwise Northwest (503-381-6282). Startup service shall include but not be limited to the following.
   1. Complete installation and startup check according to district requirements and manufacturer's written instructions.
   2. Verify that electrical wiring installation and data communications complies with district requirements and manufacturer's submittals.
   3. Set-up and verify communication to district's Maxicom computer system.
   4. Verify all required sensors installed and calibrated.
   5. Confirm proper grounding for all components.
   6. Operate low flow test schedule from Maxicom during evening hours and record log flow volumes for all zones.
   7. Populate Maxicom database with flow values.
   8. At final acceptance, system shall run from Maxicom remotely using smart-phone, tablet, or similar.

3.17 ADJUSTING

A. Adjust settings of controllers at direction of the Owner's Representative.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.18 CLEANUP

Upon completion, wash clean all surfaces impacted by irrigation construction. Coordinate with Owner's Representative prior to cleaning.

A. Repair all grade ruts caused by irrigation system testing.

B. Remove and properly dispose of excess backfill materials, packaging, and other material brought to the site.

3.19 MAINTENANCE

A. General: Provide a minimum one-year maintenance period unless otherwise indicated on Contract Documents. The maintenance period shall start on the following date of written acceptance of system installation.
   1. Maintain a log of visits with activities performed.

B. After two weeks of operation, flush lines and remove particulates from system. Adjust and clean all filters or screens twice a month.

C. Once a month, review site conditions and assess for signs of over or under watering. Inspect plant growth and vigor; adjust watering schedule, as necessary.
   1. Inspect controller for proper functioning. Verify zone timing settings at each inspection visit.
   2. Repair and adjust system throughout Warranty Period.

D. Perform seasonal winterization and system start-up services. Demonstrate start-up and winterization, including manual system shut off valve locations, in the presence of the Owner or their personnel representatives.

3.20 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

B. Operate the system in the presence of the Owner's Representative to demonstrate satisfactory performance and coverage.

END OF SECTION

SECTION 32 9113
SOIL PREPARATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes planting soils and layered soil assemblies specified by performance requirements.

B. Related Requirements:
   1. Section 32 92 00 "Turf and Grasses" for placing planting soil for turf and grasses.
   2. Section 32 93 00 "Plants" for placing planting soil for plantings, fertilizers, including biochar and mycorrhizae in backfill soil.

1.03 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Amendment: Physical, chemical, or biological material additive that adjusts the physical and/or chemical structure of base soil. Materials may include sand, compost, fertilizer, biological additives, and pH modifiers.

C. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended, or unamended soil as indicated.

D. CEC: Cation exchange capacity.

E. Coefficient of Uniformity: Numerical expression of distribution of dry weight soil particles in a sample, passed through sieves, that is the ratio between particles that are 60 percent finer and 10 percent finer within the sample (expressed as D60/D10).

F. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

G. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

H. Field Capacity: The amount of water in soil after excess water has drained away and ceased two to three days after a wetted event.

I. Friable: Crumbly texture of soil where larger clumps of soil can be broken into smaller, crumbly pieces by light rubbing.

J. Imported Soil: Soil that is transported to Project site for use.

K. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

L. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

M. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

N. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

O. Planting Area: Areas on site to be planted or seeded within planting soil.

P. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

Q. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

R. Saturated Soils: Water that fills the entirety of soil pores between soil particles.

S. Scarification/Scarify: Alleviation of compaction and consolidation of soil by any number of methods including loosening, turning, fracturing, or roughening through mechanized or manual means.

T. SSSA: Soil Science Society of America.

U. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

V. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

W. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

X. Stormwater Planting Soil: Planting medium used in a vegetated stormwater facility that is suitable for plant growth and vigor manufactured from existing on-site topsoil, imported topsoil, blended soil mix, or a combination thereof that includes necessary amendments and other soil additions further defined in this specification.

Y. Till: Scarification method, often with mechanized equipment, that turns, digs, or stirs soil to alleviate compaction and mix soil.

Z. USCC: U.S. Composting Council.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include recommendations for application and use.
   2. Include test data substantiating that products comply with requirements.
   3. Include sieve analyses for aggregate materials.
   4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
      a. Manufacturer's qualified testing agency's certified analysis of standard products.
      b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
      c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-gal. volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

D. Soil Work Plan: 90 days prior to planting soil installation, submit a written statement that describes the soil design method(s) that will be utilized including the following:
   1. Soil testing locations and timeline.
   2. Ability to use existing surface soils for final planting soil design and location of surface soil stockpiles.
   3. Location and source of amendments.
   4. Soil blending material operations needed to create planting soil including potential equipment desired to use.
   5. Responsibility of subgrade preparation.
   6. Weed removal and abatement process.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
   1. Laboratories: Subject to compliance with requirements, provide testing by one of the following:
      a. Soil and Plant Laboratory, Inc.; www.soilandplantlaboratory.com.
      b. Western Agricultural Laboratories; www.al-labs-west.com.
      c. Approved equal.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on imported soil.
   1. Notify Owner's Representative seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
   1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.09 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by soil scientist (RPSS) registered by the National Society of Consulting Soil Scientists or state-certified, -licensed, or -registered soil scientist under the direction of the testing agency.
   1. Number and Location of Samples: Minimum of three representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.
   2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
   3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
   4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Test Locations: Test the following areas separately:
   1. East Side of the School (Existing Lawn Area/Slope)
   2. West Side of School (Existing Play/Field Area)

C. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
    a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
    b. Hydrometer Method: Report percentages of sand, silt, and clay.
2. Bulk Density: Analysis according to core method and clod method of SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85 percent compaction according to ASTM D698 (Standard Proctor).

D. Chemical Testing:
1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

E. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of SSSA NAPT WERA-103, including the following:
1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm and sodium absorption ratio.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

F. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."

G. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inchdepth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inchdepth of soil.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways, and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.01 PLANTING SOILS, GENERAL

A. Planting soils may be created from native & imported surface soils with the addition of imported inorganic soil amendments, organic soil amendments, and fertilizers as necessary that meets the requirements in "Planting Soils Specified by Composition" Article.

B. Stormwater plantings soils shall only be imported, pre-blended mix from manufacturer.

2.02 PLANTING SOILS SPECIFIED BY COMPOSITION

A. Type A1 - Lawn Areas: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil with soil amendments and fertilizers in quantities recommended in soil test to produce planting soil for supporting lawn in areas noted on plans. Use specific Test location (East or West) to provide site specific guidance for amendments.

B. Type A2 - Sports Fields: Existing, on-site surface soil stockpiled on-site; modified to produce viable sports field soil using 50% imported sand. Blend existing, on-site surface soil with soil amendments and fertilizers in quantities recommended in soil test to produce planting soil for supporting lawn in areas noted on plans. Use specific Test location (East or West) to provide site specific guidance for amendments.

C. Type B - Stormwater Plantings Soil: Stormwater Grassy Compatible Swale Mix per City of Eugene Stormwater Management Manual guidance; 12” depth over prepared subgrade.
1. Product: Lane Forest Products; Water Quality Mix

D. Type C - Camas Meadow: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil with soil amendments and fertilizers in quantities recommended in soil test to produce planting soil for supporting lawn in areas noted on plans. Use specific Test location (East or West) to provide site specific guidance for amendments.

E. Type D - Shrub / Ground Cover Areas: Imported planting soil, 12” depth over prepared subgrade.
1. Product: Lane Forest Products; Nature’s Best Planting Soil
2. Option to provide amended on-site soil in areas not impacted by w/ testing and amendments

PART 3 - EXECUTION

3.01 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections. Placing and mixing process may vary based up planting soil approach utilized.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.02 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches and stockpile until amended.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Clean soil to contain a combined maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: Pass unamended soil through a 2-inch sieve to remove large materials.

3.03 PLANTING SOIL TYPES A1, A2, C - PLACING AND MIXING PLANTING SOILS OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials, scarify, or till if existing soil or subgrade is frozen, muddy, saturated, or excessively wet.

B. Subgrade Preparation: Scarify subgrade to a minimum depth 12 inches. Remove organic materials such as stones, sticks, and roots larger than 1-1/2 inches in any dimension. Remove organic materials exceeding dimension requirement and in addition all trash, rubbish and other extraneous matter of any dimension and legally dispose of them off Owner's property.
   1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 4 inches] of subgrade. Spread remainder of planting soil.

C. Mixing: Spread unamended soil to total depth 12 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
   1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
      a. Mix lime and sulfur, if needed with dry soil before mixing fertilizer.
      b. Mix fertilizer with planting soil no more than seven days before planting.
   2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 12 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 82 percent of maximum Standard Proctor density according to ASTM D698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.04 PLANTING SOIL TYPE B, D: PLACING MANUFACTURED PLANTING SOIL IN RAISED PLANTERS & STORMWATER PLANTERS

A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials, scarify, or till if existing soil or subgrade is frozen, muddy, saturated, or excessively wet.

B. Subgrade Preparation: Planter layers should be ready to accept planting soils, with gravel, piping, and filter layers installed. Remove any organic materials in addition all trash, rubbish and other extraneous matter of any dimension and legally dispose of them off Owner's property.

C. Application: Spread planting soil to total depth required of 12 inches, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
   1. Lifts: Apply planting soil in one lift.

D. Compaction: Compact each lift of planting soil to 75 percent of maximum Standard Proctor density according to ASTM D698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.05 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

A. Application: Apply 3 inches of compost to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, saturated, or excessively wet.

B. Blending: Till compost into surface of in-place planting soil and thoroughly incorporate to a depth of 6 inches.

C. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests:
   1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698. Space tests at no less than one for each 2000 square feet of in-place soil or part thereof.
   2. Performance Testing: For each amended planting-soil type, demonstrating compliance with specified performance requirements. Perform testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

C. Soil will be considered defective if it does not pass tests and inspections.

D. Prepare test reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.07 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Vehicle traffic.
   4. Foot traffic.
   5. Erection of sheds or structures.
   6. Impoundment of water.
   7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Owner's Representative and replace contaminated planting soil with new planting soil.

3.08 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
   1. Dispose of excess subsoil and unsuitable materials on-site where directed.

END OF SECTION

SECTION 32 9200
TURF AND GRASSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Seeding.
   2. Hydroseeding.

B. Related Requirements:
   1. Section 32 91 13 “Soil Preparation” for seeding and planted areas.
   2. Section 32 93 00 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.03 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 32 91 13 "Soil Preparation" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
   1. Certification of each seed mixture. Include identification of source and name and telephone number of suppliers.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
   1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
   2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
      a. Landscape Industry Certified Technician - Exterior.
      b. Landscape Industry Certified Lawn Care Manager.
      c. Landscape Industry Certified Lawn Care Technician.
   5. Pesticide Applicator: State licensed, commercial.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk materials with appropriate certificates.

1.09 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
   1. Spring Planting: March to April 15.
   2. Fall Planting: September to October 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.01 SEEDED LAWN

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:
   1. Quality, State Certified: State-certified seed of grass species as listed below for solar exposure.
   2. Full Sun, Cool-Season Grass: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
   3. Sun and Partial Shade, Cool-Season Grass: Proportioned by weight as follows:
      a. 50 percent Kentucky bluegrass (Poa pratensis).
      b. 30 percent chewings red fescue (Festuca rubra variety).
      c. 10 percent perennial ryegrass (Lolium perenne).
      d. 10 percent redtop (Agrostis alba).

2.02 TURFGRASS SOD

A. Turfgrass Sod: Certified complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species, Cool-Season Grass: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
   1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
   2. Sun and Partial Shade: Proportioned by weight as follows:
      a. 50 percent Kentucky bluegrass (Poa pratensis).
      b. 30 percent chewings red fescue (Festuca rubra variety).
      c. 10 percent perennial ryegrass (Lolium perenne).
      d. 10 percent redtop (Agrostis alba).

2.03 MEADOW SEED

A. Seeded Meadow: Sunmark Seeds EcoLawn Plus mix; overseed mix with additional seed supplementing mix w/ Camassia quamash seed.

B. Seed at 5 lb per 1000 SF total (4.73 Sunmark EcoLawn Plus, 0.27 lb Camassia)

2.04 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   1. Composition:
      a. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition:
      a. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.05 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   1. Organic Matter Content: 50 to 60 percent of dry weight.
   2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.06 PESTICIDES

A. General: Pesticide use is limited to City of Eugene and 4J guidelines

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner's Representative and replace with new planting soil.

3.02 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 13 "Soil Preparation."

B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Owner's Representative's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.04 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.05 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
1. Mix slurry with nonasphaltic or fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.06 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
   1. Lay sod across slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 with steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.07 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
   1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
   2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
   3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
   1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
   2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
   1. Mow Kentucky bluegrass to a height of 1-1/2 to 2 inches.

D. Turf Postfertilization: Apply slow-release fertilizer after initial mowing and when grass is dry.

3.08 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Owner's Representative:
   1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
   2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.09 PESTICIDE APPLICATION

A. Pesticide use is limited to City of Eugene and 4J guidelines.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.11 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:
   1. Seeded Turf: 60 days from date of Substantial Completion.
      a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
   2. Sodded Turf: 30 days from date of Substantial Completion.

END OF SECTION

SECTION 32 9300
PLANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
1. Plants.
2. Fertilizers.
3. Pesticides and herbicides.
4. Mulch.
5. Tree stabilization.
6. Landscape edgings.
7. Landscape boulders.

B. Related Requirements:
1. Section 01 56 39 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 31 10 70 "Erosion Control" for temporary erosion control measures related to plant installation.
3. Section 32 84 00 "Planting Irrigation" for installation of irrigation equipment around trees and shrubs.
4. Section 32 91 13 "Soil Preparation" for preparation of plant bed soil prior to or during planting.
5. Section 32 92 00 "Turf and Grasses" for turf (lawn), hydroseeding, and erosion-control materials.

1.03 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants established in the ground and dug with firm, natural balls of earth in which they were grown and wrapped with burlap and twine.

C. Balled and Potted Stock: Plants established in the ground dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container.

D. Bare-Root Stock: Plants established in the ground that are dug and delivered with soil or growing medium removed from its roots.

E. Branch: An outgrowing shoot, stem or twig that grows from the main stem or trunk.

F. Caliper: The measurement of a nursery stock tree as determined in the latest edition of the ANSI Z60.1.

G. Container-Grown Stock: Plants established above ground grown in a removable tub or pot container filled with growing medium.

H. Crown: The portion of a tree consisting of leaves and branches.

I. Defective Plant: Any plant that fails to meet the plant quality requirements of this Section.

J. Fabric Bag-Grown Stock: Plant grown within a fabric bag in-ground to manipulate root growth to develop a fibrous root system within the bag. Fabric bags may be used above ground as a container.

K. Finish Grade: Elevation of finished surface of planting soil.

L. Healthy: Description of quality related to living plants that are growing in a condition that expresses their leaf size, crown density, color and annual growth rates typical of their horticultural description in the region.

M. Included Bark: Ingrown bark tissues that develop where two or more stems grow closely together creating weak stem connections prone to breaking.

N. Kinked Root: A root within the root package that bends more than 90 degrees.

O. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

P. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

Q. Plug: Seeding or rooted cuttings grown in a cylinder of planting medium at a nursery. Sometimes referred to as a "tubeling."

R. Planting Area: Areas to be planted with any combination of groundcovers, shrubs, trees and installed with mulch.

S. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.

T. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, plugs, tubelings, ground covers, ornamental grasses, bulbs, corms, tubers, or any herbaceous vegetation.

U. Root Crown; Root Flare; Root Collar; Trunk Flare: The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots and "flares" away from the tree's trunk; the area of transition between the root system and the stem or trunk.

V. Root Ball: The mass of roots including any soil or substrate that is shipped with the tree within the root ball package.

W. Shrub: Wood plants with mature height approximately less than 15 feet.

X. Stem: Structure and support of a plant connecting the roots and leaves; may be woody or herbaceous.

Y. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

Z. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

AA. Tree: Single and multi-stemmed plants with mature height approximately greater than 15 feet.

BB. Trunk: Portion of woody stem or stems of a tree between the roots and the canopy.

CC. Vine: Woody or herbaceous climbing plant material.

DD. Whip: A young tree without branches

1.04 COORDINATION

A. Coordination with Turf (Lawns) and Seeded Areas: Plant trees, shrubs, and other plants after finish grades are established and before planting turf and seeded areas unless otherwise indicated.
   1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.
   2. Coordinate planting installation with planting soil installation according to Section 32 91 13 "Soil Preparation."

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials. Invoices to be provided a maximum of one month after authorization to proceed. Copies must indicate source of supply by name, address, and phone number.
      a. Photos: Include digital photographs of nursery site visits for all plants proposed to be purchased from sources.
   2. Product Data: For each type of product indicated.

B. Samples for Verification: For each of the following:
   1. Bark and Compost Mulch: 1-quart volume of each mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
   2. Rock Mulch: 1-quart of each rock mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
   3. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Inspection Certificates: For plant materials furnished. Provide to Owner's Representative inspection certificates required by law for each shipment of plant materials.

C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
   1. Manufacturer's certified analysis of standard products.
   2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

E. Sample Warranty: For special warranty.

1.08 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.09 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
   1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
   2. Experience: Five years' experience in landscape installation.
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Pesticide and Herbicide Applicator: State licensed, commercial.
   5. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:
      a. Landscape Industry Certified Technician - Exterior.
      b. Landscape Industry Certified Interior.
      c. Landscape Industry Certified Horticultural Technician.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
   1. Selection of plants purchased under allowances is made by Owner's Representative, who tags plants at their place of growth before they are prepared for transplanting.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
   1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
   2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Owner's Representative may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Owner's Representative may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
   1. Notify Owner's Representative of sources of planting materials seven days in advance of delivery to site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Store fertilizers in a dry place and protect from moisture.
   3. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   4. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
   1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

G. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

H. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist. Plant materials showing damage from shipping, storage or handling will be rejected and shall be replaced at the Contractor's expense.
   1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.

2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.11 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
1. West of Cascade Mountains: September 1 through May 15.
2. Plants with Automatic Irrigation: Installed outside the above planting periods only with prior written approval from Owner's Representative.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
   b. Visual presence of plant diseases or insect infestations.
   c. Structural failures including plantings falling or blowing over.
   d. Faulty performance of tree stabilization.
   e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Periods: From date of Substantial Completion.
   a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
   b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
   c. Annuals: Three months.
3. General: The warranty period for plantings will include the healthy survival of 100 percent of the trees; the healthy survival of 100 percent of shrubs, ornamental grasses, and vines; and the healthy survival of 100 percent of groundcovers, plugs, perennials and biennials.
4. Include the following remedial actions as a minimum:
   a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
   b. Replace plants that do not meet the minimum healthy survival percentage requirements at end of warranty period.
   c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.
5. Warranty Guarantee: A financial instrument as a warranty guarantee in the amount of 100 percent of the contract amount (including all labor, equipment, and materials). Acceptable instruments for the warranty guarantee are as follows:
   a. A warranty guarantee incorporated with the performance guarantee.
   b. A maintenance bond.
   c. Cash deposit with Owner.
6. Warranty Exemptions: After Substantial Completion acceptance and during the warranty period, incidents that exempt replacement include: plants removed by others, plants that

are lost or damaged, plants impacted due to occupancy of project, plants lost or damaged by a third party, plants lost due to vandalism, or any natural disaster impacting plants.

7. Warranty Period Closure: During and by the end of the warranty period, remove all tree wraps, ties, and guying. All trees that lack sufficient caliper to remain upright or those requiring further anchorage are to remain staked as approved by the Owner's Representative.
8. End of Warranty and Final Acceptance: Upon written request prior to the end of the warranty period date, the Owner's Representative will observe all warranted Work for final acceptance.

1.13 SUBSTITUTION REQUESTS

A. Size and species of plants that cannot be obtained due to lack of availability can be requested to be substituted. Submit all requests to Owner's Representative with a list of plant sizes, species, and nursery contact information for approval prior to issuing a formal submittal.

PART 2 - PRODUCTS

2.01 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated on Drawings.
   1. All plant materials furnished, including root ball dimensions or container size to trunk caliper ratio, shall comply with ANSI Z60.1 where applicable.
   2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
   3. Provide plants of sizes, grades, and ball or container sizes for types and form of plants. Plants of a larger size may be used if acceptable to Owner's Representative, with a proportionate increase in size of roots or balls.
   4. Compliance: All plant materials shall comply with state and Federal laws and regulations for plant diseases, pests, and weeds.
   5. Cold storage plants are not permitted.

B. Plant Quality: Furnish plants with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, conks, pests, eggs, larvae, and defects such as knots, gals, lesions, sun scald, injuries, abrasions, wood cracks, sap leakage, flush pruning cuts, and disfigurement.
   1. Trees: Relatively straight, vertical trunk typical of species, capable of standing upright without supplemental staking, and with a single central leader. Crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable conditions.
   2. Graft Unions: Unions, where applicable, are completely closed, without signs of rejection, healed, and visible above the root ball soil line.
   3. Root-Ball Quality: Measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting. Root balls with roots favoring one side of the ball or with kinked roots are subject to be rejected.
   4. Crown: Form and density typical of species, its stage of growth, and time of year.
   5. Leaves: Size, color, and appearance typical of species, its stage of growth, and time of year and be absent of wilted, shriveled, or dead leaves.
   6. Branches: Even distribution of shoot growth throughout the crown typical of species, time of year, and absent of dead, diseased, broken, distorted or injured stems.
   7. Trunk: crooked trunks with wounds, conks, cracks, lesions, or inadequate pruning scars; Relatively straight, vertical typical of species and free of wounds that penetrate e the wood, sunburned areas, conks, wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties or lesions.

C. Balled and Burlapped Plants: Furnish field grown plants dug with firm, natural ball of earth in which they were grown in complying with ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine and optionally accompanied with a

wire basket. Root flare to be visible at the surface of the ball as recommended by ANSI Z60.1. Burlap and twine materials to be natural and fully biodegradable.

D. Container Plants: Furnish healthy, vigorous, well-rooted plants grown in a removable and recyclable container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container but not root bound. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Bare-Root Plants: Furnish plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required. Plants to be harvested while fully dormant and a minimum of 4 weeks before leafing out.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Labeling: Label each individual tree and at least one plant of each variety and size for all other plant types with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

H. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

I. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

J. Specimen Tree: See Plant Legend for description.

2.02 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots. Fertilizers to meet 0-F-241D, “Federal Specification, Fertilizer, Mixed, Commercial.”
   1. Size: 10-gram tablets.
   2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.03 MULCHES

A. Bark Mulch: Commercially produced, free from deleterious materials, sawdust, wood shavings, and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Type: Ground or shredded bark hemlock.
   2. Size Range: 1-1/2-inch minus, fine to medium texture.
   3. Color: Natural.

B. Compost Mulch: Commercially produced, well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-1/2 inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   1. Organic Matter Content: 50 to 60 percent of dry weight.
   2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
   3. Ratio of Carbon to Nitrogen: 25:1.

C. Rock Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:
   1. Type: Rounded riverbed gravel or smooth-faced stone.

2. Size Range: 2 inches maximum, 1 inch minimum.
3. Color: Readily available natural gravel color range.

2.04 PESTICIDES AND HERBICIDES

A. General: In accordance with approved measures in 4J District Integrated Pest Management (IPM) plan.

2.05 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:
1. Tree Stakes: Straight, square or round, rough-sawn, sound, new softwood with specified wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, nominal wood sizes and length indicated on Drawings, pointed on below grade end.
2. Tree Ties: UV resistant, flat, broad, flexible and nonabrasive material.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Wide, flexible, adjustable, nonabrasive, with appropriate slack for trunk movement and lengths required to reach tree stakes.
         a) V.I.T. Products, Inc.; "Cinch-Tie."
         b) Villa Root Barrier, Villa Rubber Tree Tie.
         c) Webbing tie; 3/4-inch wide, soft woven polypropylene fabric with a 900-pound break strength; green or beige in color; new or reclaimed material.
         d) Approved equal.

2.06 LANDSCAPE BOULDERS

A. Landscape Boulders: Natural and regionally sourced quarried rock.
1. Size: A even range from at least 2’ diameter up to 4’ + diameter.
2. Shape and Style: Angular and weathered.
3. Color: Natural.

2.07 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA U1, Use Category UC4a; acceptable to authorities having jurisdiction, and containing no arsenic or chromium.

B. Root Barrier: Black, molded, modular panels length as indicated on Drawings high (deep), 85 mils thick, and with vertical root deflecting ribs protruding 3/4 inch out from panel surface; manufactured with minimum 50 percent recycled polyethylene plastic with UV inhibitors.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. DeepRoot Green Infrastructure, LLC.
   b. NDS Inc.
   c. Villa Root Barrier.

C. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

D. Burlap: Non-synthetic, biodegradable.

E. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D448 for Size No. 8.

F. Planter Filter Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

G. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb. of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb. of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

H. Biochar: Commercially available soil amendment, high carbon fine-grained residue charcoal byproduct of sustainably sourced biomass material via pyrolysis, suitable for plant growth and soil health.

1. Cationic Exchange Capacity: 25 to 45 millieq/l.
2. Carbon: 85 wt. percent C.
3. Moisture: 15 wt. percent H20.
4. pH: 7.

I. Water: Suitable for planting irrigation and free from oil, acid, alkali, salt or other substances harmful to plant, animal or aquatic life.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
   3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   4. Uniformly moisten excessively dry soil that is not workable, or which is dusty.
   5. Verify the subgrade and planting soils are at appropriate elevations and meet all quality requirements for areas receiving plants.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner's Representative and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner's Representative acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations indicated on Drawings. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.03 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 13 "Soil Preparation."

B. Before planting, obtain Owner's Representative's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

C. Application of Mycorrhizal Fungi: Broadcast dry product uniformly over prepared soil at application rate according to soil test analysis.

3.04 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.
   1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

2. Excavate approximately two times as wide as ball diameter for balled and burlapped and or container-grown stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
8. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Subsoil and topsoil removed from excavations may only be used if amended according to 32 91 13 "Soil Preparation".

C. Obstructions: Notify Owner's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Owner's Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.05 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare above adjacent finish grades as indicated on Drawings.
1. Backfill Method: Backfill around root ball with planting soil**.**
2. After plant is set in hole, carefully cut and remove burlap, rope, and metal wire baskets as indicated on Drawings. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked, broken, or compromised where the plant cannot stand upright. Root balls that are cracked but not compromised shall have the burlap cut down to depth indicated on Drawings and loosely retied with twine to stabilize root ball before backfilling.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets.. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
   a. Quantity: Three for each caliper inch of plant].
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare above adjacent finish grades as indicated on Drawings.
1. Backfill Method: Backfill around root ball with planting soil**.**
2. Carefully remove root ball from container without damaging root ball or plant. Loosen root mass as indicated on Drawings.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets.. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
    a. Quantity: Two per plant.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.06 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Owner's Representative.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Owner's Representative, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.07 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
1. Upright Staking and Tying
    a. Stake trees 2-inch caliper or less with one stake; 2- through 4-inch caliper with two stakes; and 4- through 6-inch caliper with three stakes of length, penetrating below bottom of backfilled excavation and extending above grade to accept ties as indicated on Drawings. Set vertical stakes and space to avoid penetrating root balls or root masses with dimension indicated on Drawings.
2. Support trees with bands of flexible tree ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.08 INSTALLATION OF ROOT BARRIER

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless locations are indicated on Drawings.

B. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.
1. Position top of root barrier 1/2 inch above finish grade.
2. Overlap root barrier a minimum of 12 inches at joints.
3. Do not distort or bend root barrier during construction activities.
4. Do not install root barrier surrounding the root ball of tree or where root barrier presents a hazardous or unhealthy growing condition for the plant.

3.09 PLACING SOIL IN PLANTERS

A. Place a layer of drainage gravel at least 4 inches thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 6 inches up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.

B. Fill planter with planting soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches below top of planter, allowing natural settlement.

3.10 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.11 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Trees in Turf Areas: Apply bark mulch ring of 3-inch average thickness with 36-inch radius around trunks or stems. Do not place mulch directly onto trunks or stems of tree and maintain clear distance as indicated on Drawings.
   2. Bark Mulch in Planting Areas: Apply 2-inch average thickness of mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch directly onto trunks or stems of plants and maintain clear distance as indicated on Drawings.
   3. Rock Mulch: Apply thickness as indicated on Drawings of mulch and finish level with adjacent finish grades. Do not place mulch within 2 inches of trunks or stems.

3.12 LANDSCAPE BOULDER INSTALLATION

A. Inspect existing subgrade conditions. Verify existing soil will support weight of landscape boulders and is not excessively saturated or mucky. Stake proposed locations to receive landscape boulders for approval by Owner's Representative.

B. Excavate surrounding subsoil to accommodate entire landscape boulder or groupings of boulders. Remove any stones, gravel, or organic debris larger than 2 inches in any dimension from excavation. Subgrade and surrounding soil must be stable and capable of supporting boulders without settling.

C. Firmly compact subgrade uniformly beneath landscape boulder.

D. Place aggregate base to depth and width below boulder as indicated on Drawings. Compact aggregate base.

E. Place individual landscape boulders on top of compacted aggregate base, positioning landscape boulders generally as indicated on Drawings. Backfill and compact aggregate base in 6-inch lifts to midway point of landscaper boulder's buried depth from finish grade. Backfill and tamp planting soil to fill remaining excavation to finish grade elevation.

F. Maintain a minimum of 3 feet clear distance away from edges of pedestrian paths, walks, or vehicular routes to most exposed face of landscape boulder.

G. Landscape boulder shall be stable, firmly positioned, and able to support its own weight after installation.

H. Identify landscape boulders that are presented with sharp, hazardous edges that may present a dangerous condition. After identification, coordinate with Owner's Representative landscape boulders to be addressed. Ease and "round" any sharp or hazardous edges on landscape boulders previously identified with tools and methods that blends alterations to match existing boulder characteristics.

3.13 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting, and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.14 PESTICIDE AND HERBICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.15 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Owner's Representative.
   1. Submit details of proposed pruning and repairs.
   2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
   3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Owner's Representative.

B. Remove and replace dead or unhealthy plant materials as required in the "Warranty" Article before the end of the corrections period. Replace plants that are damaged during construction operations that the Owner's Representative determines are incapable of restoring to normal growth pattern.
   1. Provide new trees of same size as those being replaced for each tree of 4 inches or smaller in caliper size.
   2. Provide one new tree(s) of 6-inch caliper size for each tree being replaced that measures more than in caliper size.
   3. Species of Replacement Trees: Same species being replaced.

3.16 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before [**Substantial Completion**] <**Insert time**>, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.17 MAINTENANCE SERVICE

A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
   1. Maintenance Period: 12 months from date of project acceptance by Owner .

B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
   1. Maintenance Period: 12 months from date of project acceptance by Owner.

END OF SECTION

SECTION 33 0500

COMMON WORK RESULTS FOR UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Piping joining materials.
   2. Sleeves.
   3. Grout.
   4. Piping system common requirements.

1.02 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.03 SUBMITTALS

A. Welding certificates.

1.04 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 PRODUCTS

2.01 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:
   1. ABS Piping: ASTM D 2235.
   2. CPVC Piping: ASTM F 493.

3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

2.02 SLEEVES

A. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.03 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping to permit valve servicing.

D. Install piping at indicated slopes.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. Select system components with pressure rating equal to or greater than system operating pressure.

H. Sleeves are not required for core-drilled holes.

I. Permanent sleeves are not required for holes formed by removable PE sleeves.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities. Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.04 GROUTING

A. Clean surfaces that will come into contact with grout.

B. Provide forms as required for placement of grout.

C. Avoid air entrapment during placement of grout.

D. Place grout, completely filling voids and provide smooth surface.

E. Place grout around anchors.

F. Cure placed grout.

END OF SECTION

SECTION 33 1100
WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Valves and accessories
   2. Water meters and accessories
   3. Backflow preventers and assemblies.
   4. Fire hydrants.
   5. Fire department connections.
   6. Pipe.
   7. Pipe restraint

B. Field quality-control test reports.

C. Operation and maintenance data for the following:
   1. Water meters
   2. Valves
   3. Backflow preventers
   4. Hydrants

D. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
   2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
   3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

D. Comply with the following AWWA standards as applicable:
   1. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
   2. AWWA C110 – Ductile-Iron & Gray-Iron Fittings for Water.
   3. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   4. AWWA C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   5. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast, for Water.
   6. AWWA C153 – Ductile-Iron Compact Fittings for Water Service.
   7. AWWA C207 – Steel Pipe Flanges for Waterworks Services.
   8. AWWA C600 – Installation of Ductile-Iron Water Mains & Their Appurtenances.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:
   1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
   2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.04 PROJECT CONDITIONS

A. 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. Notify Architect no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of water-distribution service without Architect's written permission.

1.05 COORDINATION

A. Coordinate connection to water main with EWEB.

PART 2 PRODUCTS

2.01 GENERAL

A. All pipes and fittings delivered to the job site shall be clearly marked to identify the material, class, thickness, and manufacturer.

B. All material shall be new and free of blemishes.

C. Piping materials of like kind shall be the product of one manufacturer.

2.02 PIPE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.
   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, drawn temper.
   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, Class 52 minimum, cement-mortar lined, asphaltic-coated, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, Class 52 minimum, cement-mortar lined, asphaltic-coated, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

E. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG Class 150 and Class 200.
   1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

F. PVC Schedule 80 Pipe: ASTM D 1785.
   1. PVC Schedule 80 Socket Fittings: ASTM D 2467.
   2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

G. PVC, AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket, and with spigot end.
   1. Comply with UL 1285 for fire-service mains if indicated.
   2. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Gaskets: AWWA C111, rubber.

2.03 JOINING MATERIALS

A. Refer to Section 33 05 00 "Common Work Results for Utilities" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Soldering Flux: ASTM B 813, water-flushable type.

E. Solder Filler Metal: ASTM B 32, lead-free type with .20 percent maximum lead content.

2.04 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:
   1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
      a. Standard: AWWA C219.

2.05 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American AVK Co.; Valves & Fittings Div.
      b. American Cast Iron Pipe Co.; American Flow Control Div.
      c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
      d. Crane Co.; Crane Valve Group; Stockham Div.
      e. East Jordan Iron Works, Inc.
      f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
      g. McWane, Inc.; Kennedy Valve Div.
      h. McWane, Inc.; M & H Valve Company Div.
      i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
      j. Mueller Co.; Water Products Div.
      k. NIBCO INC.
      l. U.S. Pipe and Foundry Company.
   2. Nonrising-Stem, Resilient-Seated Gate Valves:
      a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
         1) Standard: AWWA C509.
         2) Minimum Pressure Rating: 200 psig.
         3) End Connections: Mechanical joint.
         4) Interior Coating: Complying with AWWA C550.
   3. Nonrising-Stem, Resilient Wedge Gate Valve:
      a. Description: ductile iron body bonnet and wedge. The wedge shall be encapsulated in rubber.
         1) Standard: AWWA C515.
         2) Minimum pressure rating: 200 psig.
         3) End Connections: Mechanical joint.

4) Interior coating: Complying with AWWA C550.

4. OS&Y, Rising Stem, Reduced Wall, Resilient-Seated Gate Valves.
   a. Description: Ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
      1) Standard: AWWA C515.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.
5. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
   a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Cast Iron Pipe Co.; American Flow Control Div.
      b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).McWane, Inc.; Kennedy Valve Div.
      e. McWane, Inc.; M & H Valve Company Div.
      f. Mueller Co.; Water Products Div.
      g. NIBCO INC.
      h. U.S. Pipe and Foundry Company.
   2. UL/FMG, Nonrising-Stem Gate Valves:
      a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
         1) Standards: UL 262 and FMG approved.
         2) Minimum Pressure Rating: 175 psig.
         3) End Connections: Flanged.
   3. OS&Y, Rising-Stem Gate Valves:
      a. Description: Iron body and bonnet and bronze seating material.
         1) Standards: UL 262 and FMG approved.
         2) Minimum Pressure Rating: 175 psig.
         3) End Connections: Flanged.

C. Bronze Gate Valves:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Div.
      d. Hammond Valve.
      e. Milwaukee Valve Company.
      f. NIBCO INC.
      g. Red-White Valve Corporation.
   2. OS&Y, Rising-Stem Gate Valves:
      a. Description: Bronze body and bonnet and bronze stem.
         1) Standards: UL 262 and FMG approved.
         2) Minimum Pressure Rating: 175 psig.
         3) End Connections: Threaded.

3. Nonrising-Stem Gate Valves:
    a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
        1) Standard: MSS SP-80.

2.06 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    b. East Jordan Iron Works, Inc.
    c. Flowserve.
    d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    e. McWane, Inc.; Kennedy Valve Div.
    f. McWane, Inc.; M & H Valve Company Div.
    g. Mueller Co.; Water Products Div.
    h. U.S. Pipe and Foundry Company.
2. Description: Sleeve and valve compatible with drilling machine.
    a. Standard: MSS SP-60.
    b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
    c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.07 WATER METERS

A. Water meters and water emter boxes will be furnished and installed by EWEB.

2.08 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Ames Fire & Waterworks; a division of Watts Regulator Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Watts Water Technologies, Inc.
    f. Wilkins; a Zurn company.
    g.
2. Standard: AWWA C511.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: Per Plan.

6. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved, steel with interior lining complying with AWWA C550 or that is FDA approved, or stainless steel for NPS 2-1/2 and larger.
7. End Connections: Flanged.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
    c. Above Ground Enclosure: Prefabricated fiberglass or aluminum enclosure meeting the following performance requirements:
        1) Freeze protection: Enclosure must provide at least 6.5R factor insulation. Attaching insulation to the back-flow assembly is not permitted.
        2) Heater: Enclosure shall be equipped with an integral heater unit or wrap the back-flow assembly in heat trace tape.
        3) Provide sufficient clearances to adequately access all parts of the selected back-flow assembly.
        4) Provide access so that testing and maintenance activities can be completed without having to enter the enclosure.
        5) Provide drain port(s) along the bottom of the enclosure.
        6) Enclosure shall be bolted to a concrete pad per the manufacturer's recommendations. Pad shall extend a minimum of 4-inches beyond the edge of the enclosure.

B. Double-Check Detector, Backflow-Prevention Assemblies:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Ames Fire & Waterworks; a division of Watts Regulator Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Watts Water Technologies, Inc.
    f. Wilkins; a Zurn company.
2. Standard: AWWA C510.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size: Per plan.
6. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved, steel with interior lining complying with AWWA C550 or that is FDA approved, or stainless steel for NPS 2-1/2 and larger.
7. End Connections: Flanged.
8. By-pass meter reading: gallons/min**.**
9. Configuration: Designed for [horizontal, straight through] <Insert configuration> flow.
10. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.09 WATER METER BOXES

A. Water meter boxes will be furnished and installed by EWEB.

2.10 BACKFLOW ENCLOSURE

A. Description: Heated, lockable enclosure with access on both sides. Clearances to meet EWEB requirements.
1. Slab: 6-inch concrete slab extending 6” outside of enclosure on all sides.

2.11 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Elkhart Brass Mfg. Co., Inc.
      b. Fire End & Croker Corporation.
      c. Guardian Fire Equipment, Inc.
      d. Kidde Fire Fighting.
      e. Potter Roemer.
      f. Reliable Automatic Sprinkler Co., Inc.
   2. Description: Exposed, Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high brass sleeve; and round escutcheon plate.
      a. Standard: UL 405.
      b. Connections: Two NPS 2-1/2 inlets and one NPS 6 outlet.
      c. Inlet Alignment: Inline, horizontal.
      d. Finish Including Sleeve: Rough chrome-plated.
      e. Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."
      f. Exterior Finish: Red or orange OSHA safety colors.

PART 3 EXECUTION

3.01 EARTHWORK

A. Refer to Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Piping shall be installed without springing or forcing the pipe in a manner which would set up stresses in the pipe, valves, or connecting equipment.

F. Wherever it is necessary to deflect pipe from a straight line to avoid obstructions, either in the vertical or horizontal plane, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed the lesser of what is recommended by AWWA C600 or the manufacturer.

G. Underground water-service piping NPS 3/4 to NPS 3 shall be:
   1. Soft copper tube, ASTM B 88, Type K or ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
   2. PVC, Schedule 80 socket fitting; and solvent-cemented joints.
   3. PEX Tubing; fittings recommended by the piping manufacturer for the service indicated. Engineered Polymer (EP) fittings are not allowed.

H. Underground water-service piping NPS 4 and NPS 12 shall be any of the following:
   1. Ductile-iron, [push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed] [mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical] joints.
   2. NPS 4 to NPS 12: PVC, AWWA C900 Class 150 pipe; PVC, AWWA Class 150 ductile iron, mechanical-joint fittings; and gasketed joints.

I. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 shall be hard copper tube, ASTM B 88, Type K or ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

J. Aboveground and vault water-service piping NPS 4 and NPS 6 shall be the following:
   1. Ductile-iron, flanged-end pipe; ductile-iron, flanged-end appurtenances; and flanged joints.

K. Underground Fire-Service-Main Piping NPS 4 to NPS 8 shall be any of the following:
   1. Ductile-iron, push-on-joint pipe; ductile-iron, mechanical-joint fittings; and gasketed joints.
   2. PE, Class 150, fire-service pipe; molded PE fittings; and heat-fusion joints.
   3. PVC, AWWA Class 150 pipe listed for fire-protection service; ductile iron fittings; and gasketed joints.
   4. PVC, AWWA Class 200 pipe listed for fire-protection service; ductile iron fittings; and gasketed joints.

L. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 8 shall be ductile-iron, flanged-end pipe; ductile-iron-pipe appurtenances; and flanged joints.

3.03 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, [**resilient**] -seated gate valves with valve box.
   2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
   3. Use the following for valves in vaults and aboveground:
      a. Gate Valves, NPS 2 and Smaller: Bronze, [**nonrising**] stem.
      b. Gate Valves, NPS 3 and Larger: [AWWA, cast iron, OS&Y rising stem, resilient seated] [UL/FMG, cast iron, OS&Y rising stem].

3.04 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 33 05 00 "Common Work Results for Utilities" for piping-system common requirements.

3.05 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:
   1. Install tapping sleeve and tapping valve according to MSS SP-60.
   2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
   3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
   4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
   5. Tap will be thrust blocked and have a concrete block supporting the tapping valve.

D. Make connections NPS 2 and smaller with drilling machine according to the following:
   1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
   2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.

3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G. Install PE pipe according to ASTM D 2774 and ASTM F 645.

H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

I. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches below level of maximum frost penetration.

J. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
1. Terminate water-service piping at within 5 feet of 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.

K. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, mechanical restraints, and other supports.

3.06 JOINT CONSTRUCTION

A. See Section 33 05 00 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:
1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
3. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
4. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
5. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.07 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
1. Concrete thrust blocks.
2. Locking mechanical joints.
a. Fabricated joint with single gasket meeting applicable requirements of AWWA C111 with restraint provided by a mechanical device utilizing a retainer ring welded-on the pipe spigot end.
b. Joints shall be TR Flex by McWane Ductile, Lok-Ring by American Cast Iron Pipe or approved equal.
c. Joints shall be Eagle Loc 900 by JM Eagle for PVC C-900 pipe or approved equal.
d. Allowable deflection of restrained joint pipe shall follow manufacturer’s recommendations.
3. Set-screw mechanical retainer glands.
a. Grip Ring or Roma Grip by Romac Industries, Inc; Mega-Lug by EBAA Iron Inc. or approved equal.

b. Provide the minimum restrained length of pipe on either end of the joint as required by the gland manufacturer.
c. Allowable deflection of the restrained joint pipe shall follow manufacturer's recommendations.

4. Restraining Gaskets
   a. Restraining Gaskets shall be compatible with the pipe manufacturer supplied for the project and incorporated into the work. Gaskets shall be Field-Lok by McWane Ductile, Fast-Grip by American Cast Iron Pipe, or approved equal.
5. Bolted flanged joints.
6. Heat-fused joints.
7. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
   3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.08 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.09 WATER METER INSTALLATION

A. Water meter to be installed by EWEB.

3.10 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick, concrete piers, or pipe supports.

3.11 BACKFLOW ENCLOSURE INSTALLATION

A. Install enclosure per manufacturer's recommendations.

3.12 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install protective pipe bollards [**on two sides of**] [**on three sides of**] <**Describe arrangement**> each fire department connection.

3.14 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. See Section 33 05 00 "Common Work Results for Utilities" for piping connections to valves and equipment.

C. Connect water-distribution piping to tap provided by EWEB.

D. Connect water-distribution piping to interior domestic water and fire-suppression piping.

E. Connect sump pump discharge to face to curb in University Street.

3.15 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
   1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.16 CLEANING

A. Clean and disinfect water-distribution piping as follows:
   1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
   2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
   3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
      a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
      b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 33 3100

SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:
   1. Pipe and fittings.
   2. Nonpressure and pressure couplings.
   3. Cleanouts.
   4. Manholes.
   5. Backwater valves.

1.02 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.03 SUBMITTALS

A. Product Data: For the following:
   1. Backwater valves
   2. Cleanouts
   3. Pipe material.
   4. Mechanical plugs.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Field quality-control reports.

1.04 PROJECT CONDITIONS

A. Site information: Research public utility records and verify existing utility locations prior to ordering any materials. Notify the Architect immediately if any discrepancies are found in the project survey.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to Part 3 “Piping Applications” Article for applications of pipe, fitting, and joining materials.

2.03 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C11, rubber.

2.04 PVC PIPE AND FITTINGS

A. PVC Sewer Piping, NPS 15 and Smaller:
   1. Pipe, NPS 15 and Smaller: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for solvent-cemented or gasketed joints.
   2. Fittings: ASTM D 3034, PVC with bell ends.
   3. Gaskets: ASTM F 477, elastomeric seals.

2.05 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   2. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:
   1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.06 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:
   1. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:
   1. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:
   1. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.

2.07 CLEANOUTS

A. Cleanouts: At grade cleanouts shall have an adjustable sleeve-type housing, a threaded brass plug with counter sunk slot, and cast iron frame and cover.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fittings and riser to cleanout.

2.08 MANHOLES

A. Standard Precast Concrete Manholes:
   1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints rubber gasketed joints.
   2. Diameter: 48 inches minimum unless otherwise indicated.
   3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation if site conditions warrant and/or as shown in plans.
   4. Base Section: 6-inch minimum thickness for floor slab and 5 inchminimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
   5. Riser Sections: 5-inch minimum thickness, of length to provide depth indicated.

6. Top Section: Concentric-cone unless flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Gaskets: ASTM C 443 (ASTM C443M), rubber or preformed plastic.
8. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
9. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
10. Adjusting Rings: Interlocking rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:
1. Description: Ferrous; 23-inch ID by 3- to 7-inchriser, with 3 ¼ -inch- minimum-width flange and 24 ¾-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48/A 48M, Class 35 gray iron designed for heavy duty service unless otherwise indicated.

2.09 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 3000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
a. Invert Slope: Uniform slope through manhole to match invert elevations per plans, minimum 2 percent.
2. Benches: Concrete, sloped to drain into channel.
a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.10 BACKWATER VALVES

A. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
1. Available Manufacturers:
a. Josam Co.
b. McWane, Inc.; Tyler Pipe; Wade Div.
c. Smith, Jay R. Mfg. Co.
d. Watts Industries, Inc.; Ancon Drain Div.
e. Watts Industries, Inc.; Empoco, Inc. Div.

f. Zurn Industries, Inc.; Hydromechanics Div.
g. Approved equal.

B. PVC Backwater Valve: PVC Body with extendable riser pipe.
1. Available Manufacturers:
a. Clean Check.
b. Rector Seal.
c. Mainline.
d. Approved equal

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.02 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
a. Shielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Gravity-flow, Nonpressure Sewer Piping: Use the following pipe materials for each size range unless noted otherwise in the Plans.
1. NPS 4 to NPS 15 : PVC sewer pipe and fittings gaskets, and gasketed joints.

3.03 PIPING INSTALLATION

A. Install tracer wire directly over piping and at outside edges of underground structures. See Section 31 20 00 "Earth Moving" for tracer wire material requirements.

B. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. Install gravity-flow, nonpressure, sewer piping according to the following:
1. Install piping pitched down in direction of flow, at minimum slope of 2 percent unless otherwise indicated.
2. Install piping with 36-inch minimum cover.
3. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
4. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.

G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

H. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

I. Install backwater valves in piping where indicated.

3.04 PIPE JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Section 33 05 00 “Common Work Results for Utilities.” Where specific joint construction is not indicated, follow piping manufacturer’s written instructions.

B. Join gravity-flow, nonpressure, drainage piping according to the following:
   1. Join PVC corrugated sewer piping according to ASTM D 2321.
   2. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
   3. Join dissimilar pipe materials with nonpressure-type, flexible couplings.
   4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.

C. Pipe couplings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Unshielded flexible couplings for pipes of same or slightly different OD.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.05 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface for manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.06 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.07 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use pipe fittings in sewer pipes at branches for cleanouts, and use PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
   4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, per the Detail. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.08 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drain. Use transition fitting to join dissimilar piping materials.

B. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by core drilling into existing unit. Make connection into existing pipe using an “Inserta-Tee” fitting per the manufacturer’s recommendations or approved equal. Make connection to existing manhole using round rubber gasket installed on the pipe per the manufacturer’s instructions. Cut end of connection pipe passing through the manhole wall to conform to the shape of and be flush with the inside wall unless otherwise indicated. The opening around the gasket shall be grouted to a watertight seal. Existing manhole inverts, flow lines, channels, etc. shall be chipped out and re-grouted to accommodate the new pipe.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Connect to grease interceptors.

D. Make connections to existing piping and underground structures so finished Work complies with requirements specified for new Work.

3.09 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Allowable leakage is maximum of 50 gal. /inch of nominal pipe size per mile of pipe, during 24-hour period.
    c. Close openings in system and fill with water.
    d. Purge air and refill with water.
    e. Disconnect water supply.

f. Test and inspect joints for leaks.
g. Option: Test concrete gravity sewer piping according to ASTM C 924 .

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
   a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
7. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 33 31 00

SECTION 33 4100

STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes gravity-flow nonpressure storm drainage outside the building, with the following components:
   1. Pipe and fittings.
   2. Trench Drains.
   3. Manholes.
   4. Cleanouts.
   5. Nonpressure transition couplings.
   6. Catch basins.
   7. Stormwater inlets.
   8. Pipe outlets.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Backwater valves.
   2. Cleanouts.
   3. Inlets.
   4. Pipe.
   5. Fittings.
   6. Drains.
   7. Trench Drains.

B. Shop Drawings:
   1. Precast Concrete Manholes: Include plans, elevations, sections, details, frames, and covers.
   2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
   3. Cast-in-place concrete manholes, including frames and covers.
   4. Pre-cast concrete structures, including frames and covers.
   5.

C. Field quality-control reports.

1.03 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage 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 service according to requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Architect's written permission.

B. Site Information: Research public utility records, and verify existing utility locations prior to ordering any materials. Notify Architect immediately if any discrepancies are found in the project Survey.

PART 2 PRODUCTS

2.01 Refer to Part 3 “Piping Applications” for applications of pipe, fitting, and joining materials.

2.02 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.03 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, Type S, with smooth waterway for coupling joints.
   1. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
   1. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.04 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35 with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.05 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Concrete Pipes: ASTM C 443, rubber.
   2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:
   1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:
   1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:
   1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.06 CLEANOUTS

A. Cast-Iron Cleanouts:
   1. Description: Cleanouts: At grade cleanouts shall have an adjustable sleeve-type housing, a threaded brass plug with counter sunk slot, and cast iron frame and cover.
   2. Top-Loading Classification(s): Light Duty, Medium Duty, Heavy Duty, and Extra-Heavy Duty.
   3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Plastic Cleanouts:
   1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.07 MANHOLES

A. Standard Precast Concrete Manholes:
   1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
   2. Diameter: 48 inches minimum unless otherwise indicated.
   3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation, if site conditions warrant and/or as shown in the plans.
   4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
   5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.

6. Top Section: Concentric-cone unless flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:
1. Description: Ferrous; 23-inch ID by 6- to 10-inch riser with 3.5-inch- minimum width flange and 25-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48/A 48M, Class 30 gray iron unless otherwise indicated.

2.08 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
a. Invert Slope: 2 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.
a. Slope: 8 percent.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.09 CATCH BASINS

A. Trapped Catch Basins: 10-Gauge, H-20 Rated steel plate bituminous coated as manufactured by Lynch, Gratemaster, Gibson Steel Basins, or approved equivalent. Reinforced concrete collars shall be installed per the Drawings.

B. Nyloplast Catch Basins:
1. Description: Round catch basin structure as indicated on the Contract Drawings.
2. Material: Structure shall be made out of PVC meeting ASTM D 1784. Joint tightness shall conform to ASTM D 3212. Flexible elastomeric seals shall conform to ASTM F 477.
3. Grates: Grates and frames shall be ductile iron and made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the catch basin. Grates shall be capable of supporting H-20 wheel loading for traffic areas or hold loading for pedestrian areas. Metal shall conform to ASTM A 536 grade 70-50-05 for ductile iron and be painted black.
4. Reinforced concrete collar shall be installed per the drawings.

2.10 PIPE OUTLETS

A. Cast-in-place reinforced concrete, with apron and tapered sides as shown on Plans.

PART 3 EXECUTION

3.01 EARTHWORK

1. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving." Install tracer wire directly over piping and at outside edges of underground structures. See section 31 20 00 “Earth Moving” for tracer wire material requirements.

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process or microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:
   1. Install piping pitched down in direction of flow at a minimum slope of 1 percent, unless otherwise indicated.
   2. Install piping with 36-inch minimum cover, unless otherwise indicated.
   3. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
   4. Install PE corrugated sewer piping according to ASTM D 2321.
   5. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
   6. Install piping below frost line.

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:
   1. Ductile-iron pipe and fittings.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.03 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section “Common Work Results for Utilities.” Where specific joint construction is not indicted, follow piping manufacturer’s written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:
   1. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
   2. Join ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
   3. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
   4. Join PVC corrugated sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints.
   5. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
   6. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
   7. Join dissimilar pipe materials with nonpressure-type flexible couplings.
   8. Join hub-and-spigot cast iron soil piping with gasketed joints according to CISPI’s “Cast Iron Soil Pipe and Fittings” handbook for compression joints.
   9. Join hubless cast iron soil piping according to CISPI 310 and CISPI’s “Cast Iron Soil Pipe and Fittings” handbook for hubless-coupling joints.

C. Join force-main, pressure piping according to the following:
   1. Join PVC pressure piping according to AWWA M23 for gasketed joints.
   2. Join PVC service piping according to ASTM D 2855.
   3. Join dissimilar pipe materials with pressure-type couplings.

D. Pipe couplings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Unshielded flexible couplings for pipes of same or slightly different OD.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.04 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC fittings in sewer pipes at branches for cleanouts and PVC pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
   4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, as indicated on plans. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.05 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.06 CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

3.07 NYLOPLAST CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated per the manufacturer’s recommendations.

3.08 STORMWATER OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

3.09 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.10 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 14 13 "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

C. Pipe couplings and expansion joints with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    a. Shielded flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.11 IDENTIFICATION

A. Install green tracer wire directly over piping and at outside edges of underground structure. See Section 31 20 00 “Earth Moving” for tracer wire material requirements.

3.12 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Option: Test plastic piping according to ASTM F 1417.

b. Option: Test concrete piping according to ASTM C 924.
c. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
d. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

SECTION 33 46 00

SUBDRAINAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes subdrainage systems for retaining walls, foundations, footings, under field areas and stormwater facilities:
   1. Perforated-wall pipe and fittings.
   2. Geotextile filter fabrics.
   3. Backwater valves.

1.02 SUBMITTALS

A. Product Data:
   1. For geotextile filter fabrics.
   2. Perforated pipe.
   3. Solid-wall pipe.

B. Inspection report.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Refer to Part 3 “Piping Applications” for applications of pipe, fitting, and joining materials.

2.02 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated schedule 40 ABS Pipe and Fittings: ASTM F628 or D2661, solvent welded joints.

B. Perforated schedule 40 PVC Sewer Pipe and Fittings: ASTM D 1785, D2665 or F891, solvent welded joints.

2.03 SOLID-WALL PIPES AND FITTINGS

A. ABS Schedule 40 Pipe and Fittings: ASTM D 2661 or F628 with solvent welded fittings.

B. PVC Schedule 40 Sewer Pipe and fittings: ASTM D 1785, F 1488, or D2665 with solvent welded fittings (ASTM D 2665, or DF 1866).

2.04 SPECIAL PIPE COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of the same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

2.05 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

B. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.06 SOIL MATERIALS

A. Backfill, drainage course, and satisfactory soil materials are specified in Division 31 Section 31 20 00 "Earth Moving."

2.07 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.
   1. Style(s): Flat and sock.

2.08 BACKWATER VALVES

A. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
   1. Available Manufacturers:
      a. Josam Co.
      b. McWane, Inc.; Tyler Pipe; Wade Div.
      c. Smith, Jay R. Mfg. Co.
      d. Watts Industries, Inc.; Ancon Drain Div.
      e. Watts Industries, Inc.; Empoco, Inc. Div.
      f. Zurn Industries, Inc.; Hydromechanics Div.
      g. Approved equal.

B. PVC Backwater Valve: PVC Body with extendable riser pipe.
   1. Available Manufacturers:
      a. Clean Check.
      b. Rector Seal.
      c. Mainline.
      d. Approved equal

PART 3 EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section 31 20 00 "Earth Moving."

3.02 PIPING APPLICATIONS

A. Underground Subdrainage Piping:
   1. Perforated PE pipe and fittings, couplings, and coupled joints.
   2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Header Piping:
   1. Cast-iron soil pipe and fittings, Extra-Heavy or Service class gaskets; and gasketed joints.
   2. PE Drainage tubing and fittings, couplings, and coupled joints.
   3. PVC sewer pipe and fittings, couplings and coupled joints.

C. Stormwater Facility
   1. Perforated PE Pipe and fittings, couplings, and coupled joints.
   2. Perforated PVC Sewer Pipe and fittings, and loose, bell-and-spigot joints.

3.03 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:
   1. At Grade in Earth: PVC Cleanouts.
   2. At Grade in Pave Areas: PVC cleanouts.

B. In Underground Subdrainage Piping:
   1. Buried in Earth: PVC Cleanouts.
   2. At Grade in Pave Areas: PVC cleanouts.

3.04 FOUNDATION DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests. Refer to Part 3 “Field Quality Control.”

F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

3.05 UNDER FIELD DRAINAGE INSTALLATION

A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.

E. Install drainage piping as indicated in Part 3 "Piping Installation" for under field subdrainage.

F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests. Refer to Part 3 “Field Quality Control.”

G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.06 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
   1. Foundation Subdrainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.
   2. Under field Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
   3. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.
   4. Stormwater Facilities: Install Piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
   5. Lay perforated pipe with perforations down.
   6. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping according to ASTM D 2321.

D. Install PVC piping according to ASTM D 2321.

3.07 PIPE JOINT CONSTRUCTION

A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO’s “Standard Specifications for Highway Bridges,” Division II, Section 26.4.2.4, “Joint Properties.”

B. Join perforated PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4 "Joint Properties"; or according to ASTM D 2321 with loose banded, coupled, or push-on joints.

C. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

D. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

E. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.08 BACKWATER VALVE INSTALLATION

A. Comply with requirements for backwater valves specified in Section 33 41 00 "Storm Utility Drainage Piping."

B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.

C. Install horizontal backwater valves in piping manholes or where indicated.

3.09 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 33 41 00 "Storm Utility Drainage Piping."

B. Cleanouts for Foundation and Retaining-Wall Subdrainage:
   1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
   2. In vehicular-traffic areas, use NPS 4 PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, as shown on Drawings. Set top of cleanout flush with grade.
   3. In non-vehicular-traffic areas, use NPS 4 PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, as shown on Drawings. Set top of cleanout 1 inch above grade.

C. Cleanouts for Under field Subdrainage:
   1. Install cleanouts and riser extensions from piping to 8" below finished grade. Locate cleanouts where shown on plans. Install fittings so cleanouts open in direction of flow in piping.
   2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.10 CONNECTIONS

A. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

3.11 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
   2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.12 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

Appendix A

Referenced AIA Documents

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

(Witness)	*(Contractor as Principal)* *(Seal)*
	(Title)
(Witness)	*(Surety)* *(Seal)*
	(Title)

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONSTRUCTION CONTRACT
Date:
Amount: $ 0.00
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONSTRUCTION CONTRACT
Date:
Amount: $ 0.00
Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: ☐ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL	**SURETY**
Company: *(Corporate Seal)*	Company: *(Corporate Seal)*
Signature: _____	Signature: _____
Name and Title:	Name and Title:

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the

Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

BLANK DOCUMENTS

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

PIVOT Architecture, Professional Corporation
44 West Broadway. Suite 300
Eugene, OR 97401

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set

forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately

suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not

have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will

similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the

Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor

change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot

be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;
.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented

to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;

.3 terms of special warranties required by the Contract Documents; or
.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The

Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds

of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the

other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with this certification 12:54:07 on 01/16/2018 under Order No. 3935667535 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ - 2017, General Conditions of the Contract for Construction, as published by the AIA in its software, other than changes shown in the attached final document by underscoring added text and striking over deleted text.

_____

(Signed)

_____

(Title)

_____

(Dated)

AIA® Document G701™ – 2017

Change Order

PROJECT: *(Name and address)*

CONTRACT INFORMATION:
Contract For:
Date:

CHANGE ORDER INFORMATION:
Change Order Number: 001
Date:

OWNER: *(Name and address)*

ARCHITECT: *(Name and address)*

CONTRACTOR: *(Name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original Contract Sum was	$	0.00
The net change by previously authorized Change Orders	$	0.00
The Contract Sum prior to this Change Order was	$	0.00
The Contract Sum will be increased by this Change Order in the amount of	$	0.00
The new Contract Sum including this Change Order will be	$	0.00

The Contract Time will be increased by Zero (0) days.
The new date of Substantial Completion will be

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Firm name)*	CONTRACTOR *(Firm name)*	OWNER *(Firm name)*
SIGNATURE	SIGNATURE	SIGNATURE
PRINTED NAME AND TITLE	PRINTED NAME AND TITLE	PRINTED NAME AND TITLE
DATE	DATE	DATE

AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:

PROJECT:

APPLICATION NO: 001
PERIOD TO:
CONTRACT FOR:
CONTRACT DATE:
PROJECT NOS: / /

Distribution to:
OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER : ☐

FROM CONTRACTOR:

VIA ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM		$0.00
2. NET CHANGE BY CHANGE ORDERS		$0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)		$0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)		$0.00
5. RETAINAGE:		
a. 0 % of Completed Work (Column D + E on G703)	$0.00	
b. 0 % of Stored Material (Column F on G703)	$0.00	
Total Retainage (Lines 5a + 5b or Total in Column I of G703)		$0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)		$0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)		$0.00
8. CURRENT PAYMENT DUE		$0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$0.00	

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$0.00	$0.00
Total approved this Month	$0.00	$0.00
TOTALS	$0.00	$0.00
NET CHANGES by Change Order		$0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

AIA® Document G703™ – 1992

Continuation Sheet

AIA Document, G702™–1992, Application and Certification for Payment, or G736™–2009, Project Application and Project Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED		MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G ÷C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
			FROM PREVIOUS APPLICATION (D + E)	THIS PERIOD					
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
	GRAND TOTAL	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**0.00%**	**$0.00**	**$0.00**

User Notes:
(3B9ADA83)

AIA® Document G704™ – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CERTIFICATE INFORMATION:** Certificate Number: 001 Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.
(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE OF SUBSTANTIAL COMPLETION**

WARRANTIES
The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:
(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED
A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within ( ) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: $

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE**
OWNER *(Firm Name)*	**SIGNATURE**	**PRINTED NAME AND TITLE**	**DATE**

AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
		ARCHITECT: ☐
	CONTRACT FOR:	CONTRACTOR: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	SURETY: ☐
		OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment ☒ Yes ☐ No

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

CONTRACTOR: *(Name and address)*

BY: _____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
		ARCHITECT: ☐
	CONTRACT FOR:	
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	CONTRACTOR: ☐
		SURETY: ☐
		OTHER: ☐

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

_____
(Signature of authorized representative)

_____
(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:

AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
	CONTRACT FOR:	ARCHITECT: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	CONTRACTOR: ☐
		SURETY: ☐
		OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(*Insert name and address of Surety*)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)

AIA® Document G707A™ – 1994

Consent of Surety to Reduction in or Partial Release of Retainage

PROJECT: *(Name and address)*

ARCHITECT'S PROJECT NUMBER:

CONTRACT FOR:

CONTRACT DATED:

TO OWNER: *(Name and address)*

OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
SURETY: ☐
OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

hereby approves the reduction in or partial release of retainage to the Contractor as follows:

The Surety agrees that such reduction in or partial release of retainage to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, OWNER,

as set forth in said Surety's bond.

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)

AIA® Document G710™ – 2017

Architect's Supplemental Instructions

PROJECT: *(name and address)*

CONTRACT INFORMATION:
Contract For:
Date:

ASI INFORMATION:
ASI Number: 001
Date:

OWNER: *(name and address)*

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Contractor shall carry out the Work in accordance with the following supplemental instructions without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.
(Insert a detailed description of the Architect's supplemental instructions and, if applicable, attach or reference specific exhibits.)

ISSUED BY THE ARCHITECT:

ARCHITECT *(Firm name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

AIA® Document G714™ – 2017

Construction Change Directive

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CCD INFORMATION:** Directive Number: 001 Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

The Contractor is hereby directed to make the following change(s) in this Contract:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits.)

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:

- ☐ Lump Sum decrease of $0.00
- ☐ Unit Price of $ per
- ☐ Cost, as defined below, plus the following fee:
  (Insert a definition of, or method for determining, cost)
- ☐ As follows:

2. The Contract Time is proposed to . The proposed adjustment, if any, is ( ).

NOTE: The Owner, Architect and Contractor should execute a Change Order to supersede this Construction Change Directive to the extent they agree upon adjustments to the Contract Sum, Contract Time, or Guaranteed Maximum price for the change(s) described herein.

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Contractor signature indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this CCD.

ARCHITECT *(Firm name)*	**OWNER** *(Firm name)*	**CONTRACTOR** *(Firm name)*
SIGNATURE	**SIGNATURE**	**SIGNATURE**
PRINTED NAME AND TITLE	**PRINTED NAME AND TITLE**	**PRINTED NAME AND TITLE**
DATE	**DATE**	**DATE**