UNIVERSITY OF NEW ENGLAND

COLLGE OF PHARMACY

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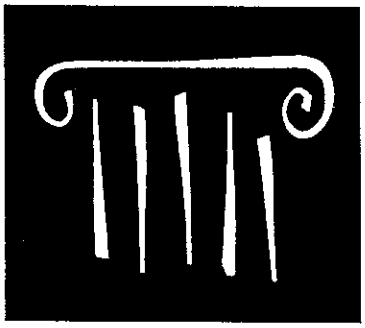
February 8, 2008

BOOK 1 OF 2



PORT ▪ CITY
ARCHITECTURE

University Of New England

College Of Pharmacy
Construction Documents

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CONTACT SHEET

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University of New England
SUPPLEMENTAL CONDITIONS
10-07-05

THE FOLLOWING RULES AND REGULATIONS OF THE UNIVERSITY OF NEW ENGLAND SHALL BE OBSERVED BY EVERY CONTRACTOR, SUBCONTRACTOR, THEIR AGENTS, SERVANTS AND EMPLOYEES:

1. CONDUCT: The contractor shall not interfere with the daily operation of the students, faculty, or business of the University. The contractor shall be responsible for the conduct of all employees, subcontractors, business invitees or other persons related to, working on, or involved in the contractors performance of the "work" on the "project". No radios are permitted on the project site without prior approval from the Owner. All workers and visitors will be restricted to the area immediately surrounding the "project" site, and will not be permitted access to the University's community facilities. Smoking is not permitted within 50 feet of any building. Contractors working on site are to be fully clothed (pants, shirts, and shoes) at all times.

2. PARKING: The University has in force, an established set of rules and regulations regarding vehicle parking, traffic regulations and towing. It will be the responsibility of the contractor to ensure that all persons, under his control, working on the "project" comply with these rules and regulations. Contractor parking on campus is limited to the construction site, or other pre-determined areas.

3. WORK HOURS: Work on the "project" will not commence prior to 7:00AM on weekdays, and will cease at 5:00PM. No work will be permitted outside these hours without the permission of the Department of Campus Services, 207-602-2262. Work in or around the residence halls must be delayed until after 9am. Week-end work is not permitted on the University's campus unless prior approval is obtained from the Department of Campus Services. In such event, all personnel will be required to report to the Security Office upon arrival and when departing the campus for the day.

4. THE UNIVERSITY FACILITIES: The contractor is required to obtain written approval from the Department of Campus Services prior to the contractors intentional causing the interruption of any of the University's fire or safety equipment or utilities, or interferes with it's normal daily operations. Appropriate, code compliant, LOCK OUT- TAG OUT procedures will be utilized by the contractor.

5. HAZARDOUS MATERIALS, HAZARDOUS WASTE & PETROLEUM PRODUCTS: THE UNIVERSITY PROHIBITS THE DISPOSAL OF ANY ENVIRONMENTALLY UNSAFE MATERIALS OR WASTE ON ITS CAMPUS, AND IN PARTICULAR THROUGH ITS DRAINAGE SYSTEMS. Any spills or accidental discharges of hazardous materials are to be immediately reported to the University's Environmental Health and Safety Coordinator, 207-602-2488. If it becomes necessary for the contractor to dispose of any chemicals, paint, or other waste materials, the University, through its Environmental Health and Safety Coordinator, will assist in arranging for such disposal, but the contractor is responsible for all expenses associated with disposal of

contractor generated wastes. The contractor is responsible for coordinating the flushing or disinfection of any utility lines with the Facilities Management Department **and** the Waste Water Treatment Plant Operator prior to initiating these activities. The contractor must also place into secondary containment all petroleum products and submit an inventory of those products to the Environmental Health and Safety Coordinator.

6. MATERIAL SAFETY DATA SHEETS: The University maintains a complete set of MSDS for any potential chemical hazards. All contractors shall have on hand MSDS for all hazardous materials used on the "project". All contractors shall comply with the appropriate laws, rules and regulations of the US Environmental Protection Agency, Occupational Safety and Health Administration, and the State of Maine, Department of Environmental Protection.

7. PERSONAL INJURY: The contractor shall report to the Department of Campus Services all personal injuries, which require medical attention, within eight (8) hours after the occurrence of such personal injury.

8. SIGNS AND BARRIERS: The contractor shall be responsible for posting all signs and erecting all barriers at the work site to prevent all unauthorized personnel from entering the work area. The contractor is responsible for ensuring the safety of all of their employees, sub-contractors and guests to the construction site.

9. ALCOHOL AND DRUGS: The consumption of any alcoholic beverage, or the use of any non -prescription drug or controlled substance is not permitted on the work site, on the campus of the University, or in any area of the University under the control and supervision of the contractor. Alcohol or drug possession on the campus, or work site, will result in the immediate removal of the individual involved, and the contractor.

10. SALES TAX: The University is tax exempt, thus does not pay sales tax for labor or materials provided to the University. The University's tax-exempt number is E101-29.

11. ADA: All work performed by the contractor shall be in compliance with the provisions of the *AMERICANS WITH DISABILITIES ACT OF 1990* (Public Law 101.336) 42 USC 12101 and the *REHABILITATION ACT OF 1973*, 34 CFR part 104, 29 USC 794

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Work phases.
4. Work under other contracts.
5. Products ordered in advance.
6. Use of premises.
7. Owner's occupancy requirements.
8. Work restrictions.
9. Specification formats and conventions.

B. Related Sections include the following:

1. Division 01 Section "Multiple Contract Summary" for division of responsibilities for the Work.
2. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: The College of Pharmacy

1. Project Location: 716 Stevens Avenue, Portland, Maine

B. Owner: University of New England

1. Owner's Representative: Alan Thibeault - Associate Director of Campus
716 Stevens Avenue, Portland, ME 04103

C. Architect: Lita Semrau - Vice President
65 Newbury Street, Portland, ME 04101

D. Contractor: John Brockington , Allied/Cook Construction P.O. Box 1369, Portland, ME 04101 has been engaged as Contractor for this Project.

E. The Work consists of the following:

The Work consists of a new building ~12,000 sf. The building will include teaching labs, a lecture hall, offices, and research lab space and support areas. The exterior of the new building will include brick, precast concrete, copper cladding, aluminum framed windows, fiberglass windows, aluminum doors, steel doors and a concrete patio. (See drawings for details). Interior finishes include gypsum wall board, acoustical panels, birch millwork, pre-fabricated millwork including lockers, paver tiles, vinyl composition tile, carpet and acoustical ceiling tiles. The building will have two elevators (a 2,500 lb and a 4,500 lb). The top floor will have research labs. Project includes all associated mechanical, electrical, plumbing, civil and structural.

1. Project is designed to comply with a Certification Level according to the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) Rating System, as specified in Division 01 Section "Sustainable Design Requirements."

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.5 PRODUCTS ORDERED IN ADVANCE

A. General: Owner has negotiated Purchase Orders with suppliers of material and equipment to be incorporated into the Work. Owner will assign these Purchase Orders to Contractor. Costs for receiving, handling, storage if required, and installation of material and equipment are included in the Contract Sum.

1. Contractor's responsibilities are same as if Contractor had negotiated Purchase Orders, including responsibility to renegotiate purchase and to execute final Purchase-Order agreements.

1.6 USE OF PREMISES

A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

C. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated without permission of the owner.

1. Limits: Confine constructions operations to area indicated on Drawings.

a. Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 5 feet (1.5 m) beyond primary roadway curbs,

walkways, and main utility branch trenches; and 25 feet (7.6 m) beyond pervious paving areas.

b. At property line bordering the cemeteries, do not disturb earth within 25'-0' of property line.

2. Owner Occupancy: Allow for Owner occupancy of Project site.
3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.7 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner will occupy existing and adjacent building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.8 WORK RESTRICTIONS

A. **WORK HOURS:** Work on the "project" will not commence prior to 7:00AM on weekdays, and will cease at 5:00PM. No work will be permitted outside these hours without the permission of the Department of Campus Services, 207-602-2262. Work in or around the residence halls must be delayed until after 9am. Week-end work is not permitted on the University's campus unless prior approval is obtained from the Department of Campus Services. In such event, all personnel will be required to report to the Security Office upon arrival and when departing the campus for the day.

1.9 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.10 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: The build out of the Vivarium at the lower level. The plumbing in the slab will be in the base bid. See Drawings for indication of full extent of the add alternate.

END OF SECTION 012300

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:
   1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor's Construction Schedule.

   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the Schedule of Values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Submit draft of AIA Document G703 Continuation Sheets.
3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value.

        1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

7. 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.
8. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

10. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Progress payments shall be submitted to Architect by the **<Insert day>** of the month. The period covered by each Application for Payment is one month, ending on the date indicated on the contract and monthly thereafter.

D. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. 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.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.
16. Initial settlement survey and damage report if required.

I. Application for Payment at Substantial Completion: After issuing 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.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Interpretation (RFIs).

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections include the following:

1. Division 01 Section "Multiple Contract Summary" for a description of the division of Work among separate contracts and responsibility for coordination activities not in this Section.
2. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
3. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

    a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    b. Indicate required installation sequences.
    c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Sheet Size: At least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
3. Number of Copies: Submit **[two] <Insert number>** opaque copies of each submittal. Architect**[, through Construction Manager,]** will return **[one copy] [<Insert number> copies]**.

    a. Submit **[five] <Insert number>** copies where Coordination Drawings are required for operation and maintenance manuals. Architect**[and Construction Manager]** will retain **[two] <Insert number>** copies; remainder will be returned.**[Mark up and retain one returned copy as a Project Record Drawing.]**

4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Key Personnel Names: Within **[15] <Insert number>** days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within **[three]** **<Insert number>** days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner**[, Construction Manager,]** and Architect, but no later than **[15]** **<Insert number>** days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner,**[Construction Manager,]** Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of the Contract Documents.
    j. Submittal procedures.
    k. LEED requirements.
    l. Preparation of Record Documents.
    m. Use of the premises**[and existing building]**.
    n. Work restrictions.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Construction waste management and recycling.
    r. Parking availability.
    s. Office, work, and storage areas.
    t. Equipment deliveries and priorities.
    u. First aid.
    v. Security.
    w. Progress cleaning.
    x. Working hours.

3. Minutes: **[Architect will record]** **[Record]** and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect[**and Construction Manager**] of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. The Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility problems.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written recommendations.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at **[weekly] [biweekly] [monthly] [regular] <Insert appropriate interval>** intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner[**, Construction Manager,**] and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

      1) Review schedule for next period.

   b. Review present and future needs of each entity present, including the following:

      1) Interface requirements.
      2) Sequence of operations.
      3) Status of submittals.
      4) Deliveries.
      5) Off-site fabrication.
      6) Access.
      7) Site utilization.
      8) Temporary facilities and controls.
      9) Work hours.
      10) Hazards and risks.
      11) Progress cleaning.
      12) Quality and work standards.
      13) Status of correction of deficient items.
      14) Field observations.
      15) RFIs.
      16) Status of proposal requests.
      17) Pending changes.
      18) Status of Change Orders.
      19) Pending claims and disputes.
      20) Documentation of information for payment requests.

3. Minutes: **[Architect will record and distribute to Contractor] [Record]** the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

   a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Coordination Meetings: Conduct Project coordination meetings at **[weekly] [biweekly] [monthly] [regular] <Insert appropriate interval>** intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner[, **Construction Manager,**] and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect[**and Construction Manager**].
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Hard-Copy RFIs: **[CSI Form 13.2A] [Form at end of this Section]**.

1. Identify each page of attachments with the RFI number and sequential page number.

D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's[**and Construction Manager's**] Action: Architect[**and Construction Manager**] will review each RFI, determine action required, and return it. Allow **[seven] <Insert number>** working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Architect's actions on submittals.
    f. Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect[**and Construction Manager**] in writing within [**10**] <**Insert number**> days of receipt of the RFI response.

F. On receipt of Architect's[**and Construction Manager's**] action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect[**and Construction Manager**] within [**seven**] <**Insert number**> days if Contractor disagrees with response.

G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log [**weekly**] <**Insert time**>. [**Use CSI Log Form 13.2B.**] [**Include the following:**] [**Software log with not less than the following:**]

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect[**and Construction Manager**].
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's[**and Construction Manager's**] response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Field condition reports.
6. Special reports.

B. Related Sections include the following:
1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
2. Division 01 Section "Submittal Procedures" for submitting schedules and reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 SUBMITTALS

A. Qualification Data: For scheduling consultant.

B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

C. Preliminary Construction Schedule: Submit three opaque copies.

1. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.

D. Contractor's Construction Schedule: Submit three opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

E. CPM Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number,

activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

F. Daily Construction Reports: Keep on site for review from client, contractor or other design staff if requested.

G. Material Location Reports: Submit two copies at monthly intervals.

H. Field Condition Reports: Keep on site for review from client, contractor or other design staff if requested.

I. Special Reports: Submit two copies at time of unusual event.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, work stages, area separations, interim milestones and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review time required for review of submittals and resubmittals.
6. Review requirements for tests and inspections by independent testing and inspecting agencies.
7. Review time required for completion and startup procedures.
8. Review and finalize list of construction activities to be included in schedule.
9. Review submittal requirements and procedures.
10. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

    a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for current date to date of Final Completion. Please include any items that might effect construction timeline.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities

in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than required days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

7. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

   a. Structural completion.
   b. Permanent space enclosure.
   c. Completion of mechanical installation.
   d. Completion of electrical installation.
   e. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.
2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
3. Each activity cost shall reflect an accurate value subject to approval by Architect.
4. Total cost assigned to activities shall equal the total Contract Sum.

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first **[60] <Insert number>** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized,[**cost- and resource-loaded,**] time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than **[30] <Insert number>** days after date established for **[commencement of the Work] [the Notice to Proceed] [the Notice of Award]**.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing[**and commissioning**].

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.

7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the Schedule of Values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts **[one week] <Insert time>** before each regularly scheduled progress meeting.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 01 Section "Closeout Procedures" for submitting warranties.
5. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Divisions 02 through 49 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately **[6 by 4 inches]** on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

F. Deviations: Highlight, encircle or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review received from sources other than Contractor.

1. Transmittal Form: Use AIA Document G810.
2. Transmittal Form: Provide locations on form for the following information:

   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Specification Section number and title.
   i. Drawing number and detail references, as appropriate.
   j. Transmittal number.
   k. Submittal and transmittal distribution record.
   l. Remarks.
   m. Signature of transmitter.

3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Reviewed" or "Approved as noted."

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals with mark indicating "Reviewed" or "Approved as noted" taken by Architect.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Submit electronic submittals directly to extranet specifically established for Project.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit five copies of Product Data, unless otherwise indicated. Architect will return four copies. Mark up and retain one returned copy as a Project Record Document.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.

h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
3. Number of Copies: Submit five opaque (bond) copies of each submittal. Architect will return three copies. For structural submittal, provide two copies (one reproducible).

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or

containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit one set of Samples. Architect will retain Sample sets.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit four copies of product schedule or list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.

G. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return one copy.

a. Mark up and retain one returned copy as a Project Record Document.

K. LEED Submittals: Comply with requirements specified in Division 01 Section "Sustainable Design Requirements."

1. Number of Copies: Submit three copies of LEED submittals, unless otherwise indicated.

L. Material Safety Data Sheets (MSDSs) for LEED Certification: Submit information necessary to show compliance with LEED certification requirements, which will be the limit of the Architect's review.

1. Architect will not review non-LEED submittals that include MSDSs and will return the entire submittal for resubmittal.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

V. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S / ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Reviewed, Furnish as Corrected, Rejected, Revise and Resubmit, and Submit Specific Item.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 013540 - CONSTRUCTION WASTE MANAGEMENT PROGRAM

PART 1 - GENERAL

1.1 SUMMARY

A. Environmental Issues: Project requires special Construction Waste Management Program.
   1. Waste Management Goals: A minimum 75% of total Project waste shall be diverted from landfill.
   2. Provide documentation to show evidence that waste management, recycling, and reuse of recyclable and reusable materials have been maximized.
   3. Effect optimum control of solid wastes.
   4. Prevent environmental pollution and damage.

B. Related Work/Documents:
   1. Section 018113: Sustainable Design Requirements
   2. LEED for New Construction Version 2.2 Reference Guide – Materials & Resources Credits 2.1 and 2.1.

1.2 DEFINITIONS

A. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively.

B. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste, including construction, remodeling, repair, and demolition operations.

C. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair, and demolition operations.
   1. Rubbish: Includes both combustible and noncombustible wastes, such as paper, boxes, glass, crockery, metal and lumber scrap, tin cans, and bones.
   2. Debris: Includes both combustible and noncombustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.

D. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.

E. Sanitary Wastes:
   1. Garbage: Refuse and scraps resulting from preparation, cooking, distribution, or consumption of food.
   2. Sewage: Domestic sanitary sewage.

1.3 SUBMITTALS

A. Construction Waste Management Plan: Prior to commencement of Work, schedule and conduct meeting with Owner and Architect to discuss proposed Construction Waste Management Program.
   1. Develop mutual understanding relative to details of recycling, and rebate programs.
   2. Prepare and submit a written and graphic Construction Waste Management Plan including, but not limited to, the following:

a. Indicate procedures to be implemented.
b. Estimate total Project waste to be generated, and estimated cost of disposing of Project waste in landfills.
c. Estimate amounts of following waste categories in appropriate units (weight or volume) to be diverted from landfill.
    i. Clean dimensional wood, palette wood.
    ii. Plywood, oriented strand board, and medium density fiberboard.
    iii. Cardboard, paper, packaging.
    iv. Other items as directed by Owner and Architect.
d. Estimate amounts of following waste categories in appropriate units (weight or volume).
    i. Metals.
    ii. Gypsum board.
    iii. Carpet.
    iv. Paint.
    v. Other items as directed by Owner and Architect.
e. Submit permit or license and location of waste disposal areas.
f. Submit procedures for recycling/re-use program.
g. Submit procedures for rebate programs.
h. Revise and resubmit Construction Waste Management Plan as required by Owner and Architect.
i. Review of Contractor's Construction Waste Management Plan will not relieve Contractor of responsibility for control of pollutants and other environmental protection measures.

B. Submit summary of solid waste generated by Project with each application for progress payment, on form acceptable to Owner and Architect. Include the following information:
    1. Name of firm accepting the recovered materials or waste materials.
    2. Specify type of facility (e.g. recycler, processor, Class III landfill, MRF).
    3. Location of the facility.
    4. Type of materials.
    5. Net weights of each type of recovered material.
    6. Date of delivery.
    7. Value of the materials or tipping fee paid.

C. Prepare electronic documentation or 3-ring binder with rebate information and product documentation as required for Owner to submit LEED documentation and submit with final closeout submittals.

1.4 RECYCLING PROGRAM

A. Recycling: Implement recycling program that includes separate collection of waste materials of following types as applicable to Project:
    1. Asphalt.

2. Land clearing debris.
3. Soil.
4. Trees and shrubs.
5. Concrete and concrete blocks.
6. Brick and masonry materials.
7. Untreated lumber.
8. Clean dimensional wood and palette wood.
9. Plywood, oriented strand board, and medium density fiberboard.
10. Paper – bond.
11. Paper (e.g. newsprint).
12. Cardboard and paper packaging materials.
13. Plastics.
14. Rigid foam.
15. Insulation.
16. Ferrous metal.
17. Non-ferrous metals (e.g. copper, aluminum, etc.).
18. Glass.
19. Gypsum board (unpainted).
20. Carpet and pad.
21. Paint.
22. Beverage containers.
23. Plumbing fixtures.
24. Electrical fixtures and wires.
25. Others as appropriate.

B. Separation of Waste: Contractor and subcontractors are both required to separate recyclable materials into bins and to arrange for delivery of recyclable materials to recycling depot. Clearly label all recycling containers and list acceptable and unacceptable materials.

C. Handling: Keep materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
   1. Clean materials that are contaminated prior to placing in collection containers.
   2. Arrange for collection by or delivery to appropriate recycling center or transfer station that accepts construction and demolition waste for purpose of recycling.

D. Participate in Re-Use Programs: Rebates, tax credits, and other savings obtained for recycled or re-used materials shall accrue to Contractor.

END OF SECTION 01354

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:
1. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
2. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where

indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different 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.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of 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. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 49.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect,and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 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 Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect,] with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

A. S.W. Cole or other architect and structural engineer approvals.

3.2 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.3 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

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

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

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if

bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
	Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities	(202) 272-0080
	Available from Access Board www.access-board.gov	
CFR	Code of Federal Regulations	(888) 293-6498
	Available from Government Printing Office	(202) 512-1530
	www.gpoaccess.gov/cfr/index.html	
CRD	Handbook for Concrete and Cement	(601) 634-2355
	Available from Army Corps of Engineers Waterways Experiment Station www.wes.army.mil	
DOD	Department of Defense Military Specifications and Standards	(215) 697-6257
	Available from Department of Defense Single Stock Point www.dodssp.daps.mil	
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification	(215) 697-

		6257
	Available from Department of Defense Single Stock Point www.dodssp.daps.mil	
	Available from General Services Administration	(202) 501-1021
	www.fss.gsa.gov	
	Available from National Institute of Building Sciences	(202) 289-7800
	www.nibs.org	
FTMS	Federal Test Method Standard (See FS)	
ICC-ES	ICC Evaluation Service, Inc.	(800) 423-6587
	www.icc-es.org	(562) 699-0543
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards	(215) 697-6257
	Available from Department of Defense Single Stock Point www.dodssp.daps.mil	
NES	(Formerly: National Evaluation Service) (See ICC-ES)	
UFAS	Uniform Federal Accessibility Standards	(800) 872-2253
	Available from Access Board	(202) 272-0080
	www.access-board.gov	

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The)	(800) 242-3837

	www.aia.org	(202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America www.alca.org	(800) 395-2522 (703) 736-9666
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts www.aosaseed.com	(505) 522-1437
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722

ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industries International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCSC)	
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association www.awpa.com	(334) 874-9800
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI www.bicsi.org	(813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(773) 761-4100
	Cast Stone Institute www.caststone.org	(770) 972-3011
CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312
CDA	Copper Development Association Inc.	(800) 232-3282

	www.copper.org	(212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca/connections_online/home.htm	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CGSB	Canadian General Standards Board w3.pwgsc.gc.ca/cgsb	(800) 665-2472 (819) 956-0425
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087

DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.asce.org	(800) 548-2723 (703) 295-6300
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association www.esda.org	(315) 339-6937
FCI	Fluid Controls Institute www.fluidcontrolsinstitute.org	(216) 241-7333
FIBA	Federation Internationale de Basketball Amateur (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM	Factory Mutual System (Now FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	52 951 5146905
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America	(785) 271-0208

	www.glasswebsite.com	
GRI	(Now GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation www.intbadfed.org	441-24 223-4904
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	(613) 233-1510

ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(702) 567-8150
ITS	Intertek www.intertek.com	(800) 345-3851 (607) 753-6711
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers	(312) 332-0405

	www.naamm.org	
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193 ext. 453
NAIMA	North American Insulation Manufacturers Association (The) www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association)	(800) 344-3555 (617) 770-3000

	www.nfpa.org	
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. www.opl.com	(800) 966-5253 (210) 635-8100
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720

PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
RTI	(Formerly: NTRMA - National Tile Roofing Manufacturers Association) (Now TRI)	
SAE	SAE International www.sae.org	(724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SEI	Structural Engineering Institute www.seinstitute.com	(800) 548-2723 (703) 295-6195
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association	(703) 803-2980

	www.smacna.org	
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPI/ SPFD	Society of the Plastics Industry, Inc. (The) Spray Polyurethane Foam Division (Now SPFA)	
SPRI	SPRI (Single Ply Roofing Institute) www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(608) 833-5900
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 705-9898

TRI	Tile Roofing Institute (Formerly: RTI - Roof Tile Institute) www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(800) 285-4476 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (Now WCSC)	
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 661-4261
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 548-0112

WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc. (See ICC)	
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICBO	International Conference of Building Officials (See ICC)	
ICBO ES	ICBO Evaluation Service, Inc. (See ICC-ES)	
ICC	International Code Council (Formerly: CABO - Council of American Building Officials) www.iccsafe.org	(703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
NES	National Evaluation Service (See ICC-ES)	
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-6816

DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense www.dodssp.daps.mil	(215) 697-6257
DOE	Department of Energy www.eren.doe.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111 (202) 501-1888
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
PHS	Office of Public Health and Science http://phs.os.dhhs.gov	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000

TRB	Transportation Research Board www.nas.edu/trb	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs	(800) 952-5210
	Bureau of Home Furnishings and Thermal Insulation	(916) 574-2041
	www.dca.ca.gov/bhfti	
CPUC	California Public Utilities Commission	(415) 703-2782
	www.cpuc.ca.gov	
TFS	Texas Forest Service	(936) 639-8180
	Forest Products Laboratory http://txforestservice.tamu.edu	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

SECTION 014400 - CONSTRUCTION INDOOR AIR QUALITY

PART 1- GENERAL

1.1 REQUIREMENTS INCLUDED IN THIS SECTION

A. IAQ Management Goals

B. IAQ Management Plan

C. IAQ Management Plan Implementation

1.2 RELATED DOCUMENTS:

A. LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:
   1. EQ Credit 3.1, Construction IAQ Management Plan, During Construction – Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building.
   2. EQ Credit 3.2, Construction IAQ Management Plan, Before Occupancy – Develop and implement an IAQ Management Plan for the pre-occupancy phase.

B. Temporary ventilation as specified in the General Conditions

C. Duct cleaning as specified in Division 15 "Testing, Adjusting, and Balancing" section.

1.3 IAQ MANAGEMENT GOALS

A. The Owner has established that this Project shall prevent indoor air quality problems resulting from the construction process, to sustain long-term installer and occupant health and comfort.

B. Protect the ventilation system components during construction and cleanup of contaminated components after construction is complete.

C. Control sources of potential IAQ pollutants by controlling selection of materials and processes used in project construction.

With regard to these goals the Contractor shall develop, for Owner and Architect's review, an IAQ Management Plan for this Project

Part 2 – Products

2.1 SUBMITTALS:

A. Construction IAQ Management Plan highlighting the five requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, 1995, Chapter 3 "Control Measures".

B. Construction Documentation: Six photographs at three different occasions during construction along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

C. Cut sheets of temporary filtration media and filtration media used during occupancy with MERV values highlighted.

D. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out; AND product data for filtration media used during flush-out and during occupancy; OR report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements.

2.2 IAQ MANAGEMENT PLAN

A. LEED EQ Credit 3.1, Construction IAQ Management Plan, During Construction – Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:
   1. During construction meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3.
   2. Protect stored on-site or installed absorptive materials from moisture damage.
   3. If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return air grille, as defined by ASHRAE 52.2-1999. Replace all filtration media immediately prior to occupancy.

B. LEED EQ Credit 3.2, Construction IAQ Management Plan, Before Occupancy – Develop and implement an IAQ Management Plan for the pre-occupancy phase as follows:
   1. Option 1 – Flush-Out
      a. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,ooo cu. Ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%; OR
      b. If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cu. Ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm/sq.ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu.ft./sq.ft. of outside air has been delivered to the space; OR
   2. Option 2 – Air Testing
      a. Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the LEED for New Construction Version 2.2 Reference Guide.

b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded.

C. CONTAMINANT	D. MAXIMUM CONCENTRATION
E. Formaldehyde	F. 50 parts per billion
G. Particulates (PM10)	H. 50 micrograms per cubic meter
I. Total Volatile Organic Compounds (TVOC)	J. 500 micrograms per cubic meter
K. 4-Phenylcyclohexene (4-PCH)	L. 6.5 micrograms per cubic meter
M. Carbon Monoxide (CO)	N. 9 parts per million and no greater than 2 parts per million above outdoor levels

a. For each sampling point where the maximum concentration limits are exceeded conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test.

b. The air sample testing shall be conducted as follows:
   (1) All measurements shall be conducted prior to occupancy, but during normal occupied hours, and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
   (2) The building shall have all interior finishes installed, including but not limited to millwork, doors, paint, carpet, and acoustical tiles. Non-fixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
   (3) The number of sampling locations will vary depending upon the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq.ft., or for each contiguous floor are, whichever is larger, and include areas with the least ventilation and greatest presumed source strength.
   (4) Air samples shall be collected between 3 feet and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

C. The SMACNA IAQ Guidelines for Occupied Buildings under Construction provides an overview of air pollution associated with construction, control measures, construction process management, quality control, communicating with occupants, and case studies. These guidelines can be accessed at www.smacna.org. Chapter 3 of the SMACNA Guidelines recommends Control Measures in five areas: HVAC protection, source control, pathway interruption, housekeeping, and scheduling. Review the applicability of each Control Measure and include those that apply in the Draft IAQ Management Plan.

1. HVAC Protection: Shut down the return side of the HVAC system whenever possible during heavy construction. If the system must remain operational during construction include the following strategies that apply:
   a. Fit the return side of the HVAC system with temporary filters.
   b. Isolate the return side of the HVAC system from the surrounding environment as much as possible (e.g., place all tiles for the ceiling plenum, repair all ducts and air handler leaks).
   c. Damper off the return system in the heaviest work areas and seal the return system openings with plastic.
   d. Upgrade the filter efficiency where major loading is expected to affect operating HVAC system.
   e. Clean permanent return air ductwork per National Air Duct Cleaning Association standards upon completion of all construction and finish installation work.

f. Install new clean media just prior to substantial completion and occupancy that has a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999.

2. Source Control: Propose the substitution of non-toxic formulations of materials that are generally the responsibility of the contractor such as caulks, sealants, and cleaning products.
3. Pathway Interruption: Prevent contamination of clean spaces. Include the following strategies that apply:
   a. Use 100% outside air ventilation (when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30% and 60%) with air exhausted directly to the outside during installation of finishes and other VOC emitting materials.
   b. Erect some type of barrier between work areas or between the inside and outside of the building to prevent unwanted airflow from dirty to clean areas
4. Housekeeping: Reduce construction contamination in the building prior to occupancy through HVAC and regular space cleaning activities.
   a. Store building materials in a weather tight, clean area prior to unpackaging for installation.
   b. Check for possible damage to the HVAC and Building system from high humidity.
   c. Clean all coils, air filters, and fans before testing and balancing procedures are performed.
5. Scheduling: Specify construction sequencing to reduce absorption of VOC's by materials that act as sinks or contaminant sources. Complete application of wet and odor-emitting materials such as paints, sealants, and coatings before installing sink materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings are installed.
6. Protect stored on-site or installed absorptive materials from exposure to moisture through precipitation, plumbing leaks, or condensation from the HVAC system to prevent microbial contamination.

D. Conduct building flushout with new filtration media after construction ends and prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2-2004 OR Conduct Baseline IAQ testing as detailed in LEED - NC Reference Guide Version 2.2.

E. Draft IAQ Management Plan Review Meeting: Once the Owner and Architect have reviewed the Draft IAQ Management Plan and prior to construction at the site, schedule and conduct a meeting to review the Draft IAQ Management Plan and discuss procedures, schedules and specific requirements for IAQ during the construction and pre-construction phases of the building. Discuss coordination and interface between the Contractor and other construction activities. Identify and resolve problems with compliance to the requirements. Record minutes of the meeting, identify all conclusions reached and matters requiring further resolution.
   1. Attendees: The Contractor and related Contractor personnel associated with the work of this section, including personnel to be in charge of the IAQ management program, Architect, Owner and such additional personnel as the Architect or Owner deems appropriate.

F. Final IAQ Management Plan: Make any revisions to the Draft IAQ Management Plan agreed upon during the meeting identified in item (B) above and incorporate resolutions agreed to be made subsequent to the meeting. Submit the revised plan to the Owner and Architect for approval within 10 calendar days of the meeting.

2.3 IMPLEMENTATION OF IAQ MANAGEMENT PLAN

A. Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and the IAQ Management Plan for the Project.

B. Progress Meetings: Construction related IAQ procedures shall be included in the pre-construction and construction progress meeting agendas.

C. Distribution: The Contractor shall distribute copies of the IAQ Management Plan to the Job Site Foreman, each Subcontractor, the Owner, and the Architect.

D. Instruction: The Contractor shall provide on-site instruction of the IAQ procedures and ensure that all participants in the construction process understand the importance of the goals of the IAQ Management Plan.

END OF SECTION 01440

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include the following:

1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Division 01 Section "Execution" for progress cleaning requirements.
4. Divisions 02 through 49 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
5. Division 32 Section "Dewatering" for disposal of ground water at Project site.
6. Division 31 Section "Termite Control" for pest control.
7. Division 31 Section "Asphalt Paving" for construction and maintenance of asphalt paving for temporary roads and paved areas.
8. Division 32 Section "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

E. Sewer, Water, and Electric Power Service: Use charges are specified in Division 01 Section "Multiple Contract Summary."

F. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

G. Electric Power Service: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.6 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pavement: Comply with Division 32 pavement Sections.

B. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts.

C. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.

D. Wood Enclosure Fence: Plywood, 6 feet (1.8 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.

All wood products, project-wide: Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principle and Criteria for wood building components. These components include, but are not limited to, temporary fencing, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.

E. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."

F. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

H. Paint: Comply with requirements in Division 09 painting Sections.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room is not required. Meetings will be held in a UNE classroom to be determined.
3. Coffee machine and supplies.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

F. Heating and Cooling: Provide temporary heating and cooling 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.

G. 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.

H. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service [**overhead**] [**underground**], unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

    a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.

2. At each telephone, post a list of important telephone numbers.

    a. Police and fire departments.
    b. Ambulance service.
    c. Contractor's home office.
    d. Architect's office.
    e. Engineers' offices.
    f. Owner's office.
    g. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

L. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving."

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Use designated areas of Owner's existing parking areas (Construction Site or lower level of campus) for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings. Signs can go up as early as groundbreaking. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.

1. Provide temporary, directional signs for construction personnel and visitors.

2. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Elevator Use: Refer to Division 14 Sections for temporary use of new elevators.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 01 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 31 Section "Site Clearing."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in Division 01 Section "Temporary Tree and Plant Protection."

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

At least three weeks before occupancy, a commercial pest control company shall screen entire facility for evidence of rodents or insects and carry out a vermin-eradication program if required.

H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

I. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

L. 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.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
   1. Division 01 Section "Alternates" for products selected under an alternate.
   2. Division 01 Section "References" for applicable industry standards for products specified.
   3. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   4. Division 1 Section 018113 "Sustainable Design Requirements" for product and submittal requirements.
   5. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

a. Specification Section number and title.
b. Generic name used in the Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.
i. Cost of each product and material, separate from labor costs (For the purpose of tracking LEED Materials and Resources credits, Division 2-10 and 12 only).

3. Initial Submittal: Within 15days after date of commencement of the Work, submit **3** copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 15 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use **CSI Form 13.1A**.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
   i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
   j. Cost information, including a proposal of change, if any, in the Contract Sum.
   k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
   l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
   m. Provide LEED-required Product Data as specified in Section 018113 showing how product meets all characteristics for LEED credits targeted including but not limited to low-emitting materials, recycled content, FSC Certification, local/regional manufacture and extraction. (Add language so that LEED related issues are considered. For example: Does the specified substitution impact the project goals to achieve a LEED rating? ___NO___Yes How?)

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within **7** days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within **7** days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Follow LEED requirements for indoor air quality management during construction as outlined in IAQ Plan (see SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3) described in LEED for New Construction Version 2.2 Indoor Environmental Quality Credit 3.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.
9. Follow LEED requirements for indoor air quality management during construction as outlined in IAQ Plan (see SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3) described in LEED for New Construction Version 2.2 Indoor Environmental Quality Credit 3.

1.7 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.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Products: Where Specifications include names of products and manufacturers, provide products that have general characteristics for LEED credits (including, but not limited to, low-emitting materials, recycled content, local/regional manufacture and extraction.)
7. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
8. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.

9. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
10. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

11. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.

10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
11. Requested substitution is consistent with the requirements of the LEED credits targeted for this project and does not jeopardize the project's ability to meet those targets.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

A. Qualification Data: For **[land surveyor] [professional engineer]**.

B. Certificates: Submit certificate signed by **[land surveyor] [professional engineer]** certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit **[two] <Insert number>** copies signed by **[land surveyor] [professional engineer]**.

E. Final Property Survey: Submit **[10] <Insert number>** copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: 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.

1. 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. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to **[local utility]** **[Owner]** that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.[**Submit requests on CSI Form 13.2A, "Request for Interpretation."**]

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect[**and Construction Manager**] promptly.

B. General: Engage a **[land surveyor]** **[professional engineer]** to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect[**and Construction Manager**] when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect[**and Construction Manager**].

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect[**or Construction Manager**]. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect[**and Construction Manager**] before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of [**two**] **<Insert number>** permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by [**land surveyor**] [**professional engineer**], that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of [**8 feet (2.4 m)**] **<Insert dimension>** in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:
   1. Divisions 2 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
   2. Division 07 Section "Penetration Firestopping" for patching fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least two (2) days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

   1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
   3. Products: List products to be used and firms or entities that will perform the Work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Conveying systems.
8. Electrical wiring systems.
9. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface

containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:
1. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Division 01 Section 018113 "LEED NC Requirements Summary" for documentation requirements.
3. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Page number.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations. All cleaning practices must follow the procedures and requirements outlined in the Construction IAQ Management Plan:. Refer to Section 013550 Construction Indoor Air Quality.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to unusual operating conditions.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean ducts, blowers, and coils if units were operated without filters during construction.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 017823

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Operation manuals for systems, subsystems, and equipment.
   3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. Related Sections include the following:
   1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
   3. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
   4. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
   1. List of documents.

2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in

the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01782

SECTION 017839

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Sections include the following:
   1. Division 1 Section "Closeout Procedures" for general closeout procedures.
   2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of Record Drawings as follows:
      a. Submit one set(s) of marked-up Record Prints
         1) Electronic Media: One PDF copy, CD-R.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal.
   1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an understandable drawing technique.
      c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
   5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Each subcontractor shall keep track of field conditions daily, and record changes on record set kept at Design-Builder's job trailer. Record documents shall be maintained and current with each subcontractor's application of payment.

C. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01781

SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training videotapes.

B. Related Sections include the following:
   1. Division 1 Section "Project Management and Coordination" for requirements for preinstruction conferences.
   2. Divisions 2 through 16 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. HVAC systems, including instrumentation and controls.
   2. HVAC instrumentation and controls.
   3. Electrical service and distribution, including switchboards, and panelboards.
   4. Lighting equipment and controls.
   5. Communication systems, including voice and data equipment.

B. Training: Develop a learning objective and teaching outline. Include instruction as applicable for the following:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.

d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner with at least fourteen days' advance notice.

3.03 DEMONSTRATION AND TRAINING VIDEO

A. General: Provide manufacturer's standard prepared training videos, if available..

END OF SECTION 01820

SECTION 018100 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. OPR and BoD documentation prepared by Owner and Architect contains requirements that apply to this Section.

C. LEED for New Construction Version 2.2 Reference Guide, Energy and Atmosphere Prerequisite 1 and Energy and Atmosphere Credit 3 Enhanced Commissioning.

1.2 SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

B. Related Sections include the following:

1. Division 1 Section "HVAC Commissioning Requirements" for specific requirements for commissioning HVAC systems.

C. The requirements set forth by LEED Energy and Atmosphere Prerequisite 1 and Energy and Atmosphere Credit 3 Enhanced Commissioning as defined in the LEED for New Construction Version 2.2 reference guide must be met

1.3 DEFINITIONS

A. BoD: Basis of Design.

B. CxA: Commissioning Authority.

C. OPR: Owner's Project Requirements.

D. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.

E. TAB: Testing, Adjusting, and Balancing.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process

through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of **[each**]Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and **[each**]Contractor for use in developing the commissioning plan; systems manual; operation and maintenance training plan; and testing plans and checklists.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:

1. Coordination meetings.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Testing meetings.
4. Demonstration of operation of systems, subsystems, and equipment.

C. Provide utility services required for the commissioning process.

D. Provide the BoD documents, prepared by Architect and approved by Owner, to the CxA and **[each**]Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Provide utility services required for the commissioning process.

B. **[Each**]Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in design- and construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in operation and maintenance training sessions.
4. Participate in final review at acceptance meeting.
5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
7. Review and approve final commissioning documentation.

C. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in design- and construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in procedures meeting for testing.
4. Participate in final review at acceptance meeting.
5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.
6. Provide information to the CxA for developing construction-phase commissioning plan.
7. Participate in training sessions for Owner's operation and maintenance personnel.
8. Provide updated Project Record Documents to the CxA on a daily basis.
9. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Division 1 Section "Operation and Maintenance Data."
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures and participate in testing of installed systems, subsystems, and equipment.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Prepare a construction-phase commissioning plan. Collaborate with [**each**]Contractor and with subcontractors to develop test and inspection procedures. Include design changes and scheduled commissioning activities coordinated with overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.

C. Review and comment on submittals from [**each**]Contractor for compliance with the OPR, BoD, Contract Documents, and construction-phase commissioning plan. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the OPR and BoD.

D. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The CxA shall prepare and distribute minutes to commissioning team members and attendees within [**five**] <**Insert number**> workdays of the commissioning meeting.

E. At the beginning of the construction phase, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.

F. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the OPR, BoD, and Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.

G. Prepare Project-specific test and inspection procedures and checklists.

H. Schedule, direct, witness, and document tests, inspections, and systems startup.

I. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

J. Certify date of acceptance and startup for each item of equipment for start of warranty periods.

K. Review Project Record Documents for accuracy. Request revisions from Contractor to achieve accuracy. Project Record Documents requirements are specified in Division 1 Section "Project Record Documents."

L. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the OPR, BoD, and Contract Documents. Operation and maintenance documentation requirements are specified in Division 1 Section "Operation and Maintenance Data."

M. Prepare operation and maintenance training program and provide qualified instructors to conduct operation and maintenance training. Operation and maintenance training is specified in Division 1 Section "Demonstration and Training."

N. Videotape and edit training sessions.

O. Videotape construction progress including hidden shafts.

P. Prepare commissioning reports.

Q. Assemble the final commissioning documentation, including the commissioning report and Project Record Documents.

1.8 COMMISSIONING DOCUMENTATION

A. Index of Commissioning Documents: CxA shall prepare an index to include storage location of each document.

B. OPR: A written document, prepared by Owner, that details the functional requirements of Project and expectations of how it will be used and operated. This document includes Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

C. BoD Document: A document, prepared by Architect, that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

D. Commissioning Plan: A document, prepared by CxA, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
3. Identification of systems and equipment to be commissioned.
4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.
7. Description of observations to be made.
8. Description of requirements for operation and maintenance training, including required training materials.
9. Description of expected performance for systems, subsystems, equipment, and controls.
10. Schedule for commissioning activities with specific dates coordinated with overall construction schedule.
11. Identification of installed systems, subsystems, and equipment, including design changes that occurred during the construction phase.
12. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
13. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
14. Step-by-step procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.

E. Test Checklists: CxA**[, with assistance of Architect,]** shall develop test checklists for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. Prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. Provide space for testing personnel to sign off on each checklist. Specific checklist content requirements are specified in Division 1 Section "HVAC Commissioning Requirements." Each checklist, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested item.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Deficiencies.
8. Issue number, if any, generated as the result of test.

F. Certificate of Readiness: Certificate of Readiness shall be signed by **[each]**Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and

associated controls are ready for testing. Completed test checklists signed by the responsible parties shall accompany this certificate.

G. Test and Inspection Reports: CxA shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

H. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.

I. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BoD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

1. Creating an Issues Log Entry:

   a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
   b. Assign a descriptive title of the issue.
   c. Identify date and time of the issue.
   d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
   e. Identify system, subsystem, and equipment to which the issue applies.
   f. Identify location of system, subsystem, and equipment.
   g. Include information that may be helpful in diagnosing or evaluating the issue.
   h. Note recommended corrective action.
   i. Identify commissioning team member responsible for corrective action.
   j. Identify expected date of correction.
   k. Identify person documenting the issue.

2. Documenting Issue Resolution:

   a. Log date correction is completed or the issue is resolved.
   b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
   c. Identify changes to the OPR, BoD, or Contract Documents that may require action.
   d. State that correction was completed and system, subsystem, and equipment is ready for retest, if applicable.
   e. Identify person(s) who corrected or resolved the issue.
   f. Identify person(s) documenting the issue resolution.

3. Issues Log Report: On a periodic basis, but not less than for each commissioning team meeting, CxA shall prepare a written narrative for review of outstanding issues and a status update of the issues log. As a minimum, CxA shall include the following information in the issues log and expand it in the narrative:

   a. Issue number and title.

b. Date of the identification of the issue.
c. Name of the commissioning team member assigned responsibility for resolution.
d. Expected date of correction.

J. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the OPR, BoD, and Contract Documents. The commissioning report shall include, but is not limited to, the following:

1. Lists and explanations of substitutions; compromises; variances in the OPR, BoD, and Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the OPR, BoD, and Contract Documents and those that do not meet requirements of the OPR, BoD, and Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
2. OPR and BoD documentation.
3. Commissioning plan.
4. Testing plans and reports.
5. Corrective modification documentation.
6. Issues log.
7. Completed test checklists.
8. Listing of off-season test(s) not performed and a schedule for their completion.

K. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:

1. OPR and BoD, including system narratives, schematics, and changes made throughout the Project.
2. Project Record Documents as specified in Division 1 Section "Project Record Documents."
3. Final commissioning plan.
4. Commissioning report.
5. Operation and maintenance data as specified in Division 1 Section "Operation and Maintenance Data."

1.9 SUBMITTALS

A. Commissioning Plan Prefinal Submittal: CxA shall submit **[two] <Insert number>** hard copies of prefinal commissioning plan. Deliver one copy to **[each**]Contractor, one to Owner, and one to Architect. Present submittal in sufficient detail to evaluate data collection and arrangement process. One copy, with review comments, will be returned to the CxA for preparation of the final construction-phase commissioning plan.

B. Commissioning Plan Final Submittal: CxA shall submit **[two] <Insert number>** hard copies and two sets of electronically formatted information of final commissioning plan. Deliver one hard copy and one set of discs to Owner, and one copy to Architect. The final submittal must

address previous review comments. The final submittal shall include a copy of the prefinal submittal review comments along with a response to each item.

C. Test Checklists and Report Forms: CxA shall submit sample checklists and forms to **[each]**Contractor quality-control manager and subcontractors for review and comment. Submit **[two] <Insert number>** copies of each checklist and report form.

D. Certificates of Readiness: CxA shall submit Certificates of Readiness.

E. Test and Inspection Reports: CxA shall submit test and inspection reports.

F. Corrective Action Documents: CxA shall submit corrective action documents.

G. Prefinal Commissioning Report Submittal: CxA shall submit **[two] <Insert number>** hard copies of the prefinal commissioning report. Include a copy of the preliminary submittal review comments along with CxA's response to each item. CxA shall deliver one copy to Owner and one copy to Architect. One copy, with review comments, will be returned to the CxA for preparation of final submittal.

H. Final Commissioning Report Submittal: CxA shall submit **[two] <Insert number>** hard copies and **[two] <Insert number>** sets of electronically formatted information of the final commissioning report. CxA shall deliver one hard copy and one set of discs to Owner, and one copy to Architect. The final submittal must address previous review comments and shall include a copy of the prefinal submittal review comments along with a response to each item.

1.10 QUALITY ASSURANCE

A. Instructor Qualifications: Factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

B. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.11 COORDINATION

A. Coordinating Meetings: CxA shall conduct **[weekly] [biweekly] [monthly] <Insert frequency>** coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

B. Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.

C. Testing Coordination: CxA shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

D. Manufacturers' Field Services: CxA shall coordinate services of manufacturers' field services.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, CxA shall convene a training preparation conference to include Owner's operation and maintenance personnel, [**each**]Contractor, and subcontractors. In addition to requirements specified in Division 1 Section "Demonstration and Training," perform the following:

1. Review the OPR and BoD.
2. Review installed systems, subsystems, and equipment.
3. Review instructor qualifications.
4. Review instructional methods and procedures.
5. Review training module outlines and contents.
6. Review course materials (including operation and maintenance manuals).
7. Inspect and discuss locations and other facilities required for instruction.
8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

B. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 1 Section "Demonstration and Training."

END OF SECTION 01810

SECTION 018113 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. LEED for New Construction Version 2.2 Reference Guide.

1.2 SUMMARY

A. This Section includes general requirements and procedures for compliance with certain U.S. Green Building Council's (USGBC) LEED prerequisites and credits needed for the Project to obtain LEED for New Construction Version 2.2 certification.

1. Other LEED prerequisites and credits needed to obtain LEED certification are dependent on material selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests.
2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification are dependent on the Architect's and Engineer's design and other aspects of the Project that are not part of the Work of the Contract.

B. Related Sections include the following:

1. Divisions 01 through 49 Sections for LEED requirements specific to the Work of each of those Sections. These requirements may or may not include reference to LEED. **The submittal requirements detailed in this Section 018113 – Sustainable Design Requirements apply to all other Sections.**

2. **LEED for New Construction Version 2.2 Checklist of credits that have been targeted for this project. This checklist follows this section in the project manual.**

1.3 DEFINITIONS

A. LEED: Leadership in Energy & Environmental Design.

B. Reference Guide: LEED for New Construction Version 2.2 Reference Guide.

C. Rapidly Renewable Materials: Materials made from agricultural products that are typically harvested within a ten-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.

D. Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles (800 km) from the Project location. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.

E. Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered and manufactured within a radius of 500 miles (800 km) from the Project site.

F. Recycled Content: The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).

1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

1.4 SUBMITTALS

A. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

C. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project. Include statement indicating total cost of mechanical and electrical components.

D. LEED Action Plans: Provide preliminary submittals within fourteen days of date established for commencement of work indicating how the following requirements will be met.

1. Credit MR 2.1 and 2.2: Waste management plan complying with Division 01 Section "Construction Waste Management and Disposal."

2. Credit MR 4.1 and 4.2: List of proposed materials with recycled content.

   a. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.

3. Credit MR 5.1 and 5.2: List of proposed regionally manufactured materials and regionally extracted, harvested, or recovered materials.

   a. Identify each regionally manufactured material, its source, and cost.
   b. Identify each regionally extracted, harvested or recovered material, its source, and cost.

4. Credit MR 7.0: List of proposed certified wood products.

a. Indicate each product containing certified wood, its source, and cost.
b. Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.

5. Credit EQ 3.1: Construction indoor air quality management plan.

E. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:

1. Credit MR 2.1 and 2.2: Waste reduction progress reports complying with Division 01 Section "Construction Waste Management and Disposal."
2. Credit MR 4.1 and 4.2: Recycled content.
3. Credit MR 5.1 and 5.2: Regionally manufactured materials and regionally extracted, harvested, or recovered materials.

F. LEED Documentation Submittals:

1. Credit SS 7.2: Product Data for roofing materials indicating Energy Star compliance.
2. Credit SS 8.0: Product Data for interior and exterior lighting fixtures that stop direct-beam illumination from leaving the building site.
3. Credit WE 3.1 and 3.2: Product Data for plumbing fixtures indicating water consumption.
4. Prerequisite EA 3.0: Product Data for new HVAC equipment indicating absence of CFC refrigerants.
5. Credit EA 4.0: Product Data for new HVAC equipment indicating absence of HCFC refrigerants, and for clean-agent fire-extinguishing systems indicating absence of HCFC and Halon, if applicable.
6. Credit EA 5.0: Product Data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy and water consumption performance over time.
7. Credit MR 2.1 and 2.2: Comply with Division 01 Section "Construction Waste Management and Disposal."
8. Credit MR 4.1 and 4.2: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
9. Credit MR 5.1and 5.2: Product Data indicating location of material manufacturer for regionally manufactured materials.

    a. Include statement indicating cost and distance from manufacturer to Project for each regionally manufactured material.
    b. Include statement indicating cost and distance from point of extraction, harvest, or recovery to Project for each raw material used in regionally manufactured materials.

10. Credit EQ 1.0: Product Data and Shop Drawings for carbon dioxide monitoring system.
11. Credit EQ 3.1:

    a. Construction indoor air quality management plan.
    b. Product Data for temporary filtration media.
    c. Product Data for filtration media used during occupancy.

d. Construction Documentation: Six photographs at three different occasions during construction along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

12. Credit EQ 3.2:

a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out; AND
b. Product Data for filtration media used during flush-out and during occupancy; OR
c. Report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements.

13. Credit EQ 4.1: Product Data for adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
14. Credit EQ 4.2: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
15. Credit EQ 4.3: Product Data for carpet products indicating VOC content of each product used.
16. Credit EQ 4.4: Product Data for composite wood and agrifiber products indicating that products contain no urea-formaldehyde resin.

a. Include statement indicating adhesives and binders used for each product.

17. Credit EQ 6.2: Product Data and Shop Drawings for sensors and control system used to provide individual airflow and temperature controls for minimum 50 percent of non-perimeter, regularly occupied space.
18. Credit EQ 7: Product Data and Shop Drawings for sensors and control system used to monitor and control room temperature and humidity.

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4.1: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of five percent of the cost of materials used for the Project.

B. Credits MR 4.1 and MR 4.2: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent of the cost of materials used for the Project.

1. The cost of post-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.

2. The cost of post consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.
3. Do not include mechanical and electrical components in the calculation.
4. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).

2.2 REGIONAL MATERIALS

A. Credit MR 5.1: Provide 20 percent of building materials (by cost) that are regionally manufactured materials.

B. Credit MR 5.2: Of the regionally manufactured materials required by Paragraph "Credit MR 5.1" above, provide at least 50 percent (by cost) that are regionally extracted, harvested, or recovered materials.

2.3 LOW-EMITTING MATERIALS

A. Credit EQ 4.1: For interior applications use adhesives and sealants that comply with the limits provided in the LEED for New Construction Version 2.2 Reference Guide and all its revisions and errata for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24). The limits provided below are offered for guidance.

1. Wood Glues: 30 g/L.
2. Metal to Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Structural Glazing Adhesives: 100 g/L.
16. Wood Flooring Adhesive: 100 g/L.
17. Contact Adhesive: 80 g/L.
18. Special Purpose Contact Adhesive: 250 g/L.
19. Plastic Cement Welding Compounds: 250 g/L.
20. Structural Wood Member Adhesive: 140 g/L.
21. Sheet Applied Rubber Lining Operations: 850 g/L.
22. Top and Trim Adhesive: 250 g/L.
23. ABS Welding Compounds: 325 g/L.
24. CPVC Welding Compounds: 490 g/L.

25. PVC Welding Compounds: 510 g/L.
26. Adhesive Primer for Plastic: 550 g/L.
27. Sealants, Architectural: 250 g/L.
28. Sealants, Nonmembrane Roof: 300 g/L.
29. Sealants, Roadway: 250 g/L.
30. Sealants, Single-Ply Roof Membrane: 450 g/L.
31. Sealants, Other: 420 g/L.
32. Sealant Primers for Nonporous Substrates: 250 g/L.
33. Sealant Primers for Porous Substrates: 775 g/L.
34. Sealant Primers, Other: 750 g/L.

B. Credit EQ 4.2: For interior applications use paints and coatings that comply with the limits provided in the LEED for New Construction Version 2.2 Reference Guide and all its revisions and errata for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the following chemical restrictions. The following limits are provided for guidance:

1. Flat Paints and Coatings: VOC not more than 50 g/L.
2. Non-Flat Paints and Coatings: VOC not more than 150 g/L.
3. Anti-Corrosive Coatings: VOC not more than 250 g/L.
4. Varnishes and Sanding Sealers: VOC not more than 350 g/L.
5. Stains: VOC not more than 250 g/L.
6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
7. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

C. Credit EQ 4.4: Do not use composite wood and agrifiber products that contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.1 SITE DISTURBANCE

A. SS Prerequisite 1: Comply with requirements of Division 01 Section "Summary."

B. Credit SS 5.1: Comply with requirements of Division 01 Section "Summary."

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Credit MR 2.1 and 2.2: Comply with Division 01 Section "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Credit EQ 3.1: Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.

1. If Owner authorizes the use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
2. Replace all air filters immediately prior to occupancy.
3. Replacement air filters shall have a MERV 13 according to ASHRAE 52.2.

B. Credit EQ 3.2 – EITHER Building Air Flush-Out OR Indoor Air Quality Testing:

1. Conduct a two-week building air flush-out after construction ends with new air filters and 100 percent outdoor air. Replace air filters after building air flush-out. Replacement air filters shall have a MERV 13 according to ASHRAE 52.2.

a. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu. Ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity of no higher than 60%; OR

b. If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cu. Ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 sfm/sq. ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1 (determined by ASHRAE 62.1-2004 Ventilation Rate Procedure or the applicable local code, whichever is more stringent), whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue

during occupancy. These conditions shall be maintained until a total of 14,000 cu. Ft/sq. ft. of outside air has been delivered to the space.

2. Owner will conduct a baseline indoor air quality testing program according to EPA Protocol for Environmental Requirements, Baseline IAQ and Materials, for Research Triangle Park Campus, Section 01445. Payment for these services will be made by Owner.
3. Engage an independent testing and inspecting agency to conduct a baseline indoor air quality testing program according to EPA Protocol for Environmental Requirements, Baseline IAQ and Materials, for Research Triangle Park Campus, Section 01445.

END OF SECTION 018113

LEED for New Construction v2.2
Registered Project Checklist

DRAFT - February 8, 2008

Project Name: University of New England College of Pharmacy
Project Address: Westbrook College Campus, Allen Avenue, Portland, Maine

Yes	?	No		
8	4	1	**Sustainable Sites**	14 Points

Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
1			Credit 2	**Development Density & Community Connectivity**	1
		1	Credit 3	**Brownfield Redevelopment**	1
1			Credit 4.1	**Alternative Transportation,** Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation,** Bicycle Storage & Changing Rooms	1
1			Credit 4.3	**Alternative Transportation,** Low-Emitting & Fuel-Efficient Vehicles	1
1			Credit 4.4	**Alternative Transportation,** Parking Capacity	1
1			Credit 5.1	**Site Development,** Protect or Restore Habitat	1
1			Credit 5.2	**Site Development,** Maximize Open Space	1
	1		Credit 6.1	**Stormwater Design,** Quantity Control	1
	1		Credit 6.2	**Stormwater Design,** Quality Control	1
	1		Credit 7.1	**Heat Island Effect,** Non-Roof	1
			Credit 7.2	**Heat Island Effect,** Roof	1
	1		Credit 8	**Light Pollution Reduction**	1

Yes	?	No		
2	1	2	**Water Efficiency**	5 Points

1			Credit 1.1	**Water Efficient Landscaping,** Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping,** No Potable Use or No Irrigation	1
		1	Credit 2	**Innovative Wastewater Technologies**	1
	1		Credit 3.1	**Water Use Reduction,** 20% Reduction	1
		1	Credit 3.2	**Water Use Reduction,** 30% Reduction	1

6	2	4	**Energy & Atmosphere** 17 Points

Y	Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y	Prereq 2	**Minimum Energy Performance**	Required
Y	Prereq 3	**Fundamental Refrigerant Management**	Required

***Note for EAc1:** All LEED for New Construction projects registered after June 26th, 2007 are required to achieve at least two (2) points under EAc1.

5	Credit 1	**Optimize Energy Performance**	1 to 10
		10.5% New Buildings or 3.5% Existing Building Renovations	1
		14% New Buildings or 7% Existing Building Renovations	2
		17.5% New Buildings or 10.5% Existing Building Renovations	3
		21% New Buildings or 14% Existing Building Renovations	4
5		24.5% New Buildings or 17.5% Existing Building Renovations	5
		28% New Buildings or 21% Existing Building Renovations	6
		31.5% New Buildings or 24.5% Existing Building Renovations	7
		35% New Buildings or 28% Existing Building Renovations	8
		38.5% New Buildings or 31.5% Existing Building Renovations	9
		42% New Buildings or 35% Existing Building Renovations	10
	3	Credit 2 **On-Site Renewable Energy**	1 to 3
		2.5% Renewable Energy	1
		7.5% Renewable Energy	2
		12.5% Renewable Energy	3
	1	Credit 3 **Enhanced Commissioning**	1
		1 Credit 4 **Enhanced Refrigerant Management**	1
	1	Credit 5 **Measurement & Verification**	1
1		Credit 6 **Green Power**	1

continued...

Yes	?	No			
5	2	6	**Materials & Resources**		13 Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse,** Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse,** Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse,** Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management,** Divert 50% from Disposal	1
1			Credit 2.2	**Construction Waste Management,** Divert 75% from Disposal	1
		1	Credit 3.1	**Materials Reuse,** 5%	1
		1	Credit 3.2	**Materials Reuse,**10%	1
1			Credit 4.1	**Recycled Content,** 10% (post-consumer + ½ pre-consumer)	1
	1		Credit 4.2	**Recycled Content,** 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	**Regional Materials,** 10% Extracted, Processed & Manufactured Regional	1
	1		Credit 5.2	**Regional Materials,** 20% Extracted, Processed & Manufactured Regional	1
		1	Credit 6	**Rapidly Renewable Materials**	1
1			Credit 7	**Certified Wood**	1

Yes	?	No			
11	4		**Indoor Environmental Quality**		15 Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
	1		Credit 1	**Outdoor Air Delivery Monitoring**	1
	1		Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan,** During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan,** Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials,** Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials,** Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials,** Carpet Systems	1
	1		Credit 4.4	**Low-Emitting Materials,** Composite Wood & Agrifiber Products	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems,** Lighting	1
1			Credit 6.2	**Controllability of Systems,** Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort,** Design	1
1			Credit 7.2	**Thermal Comfort,** Verification	1
1			Credit 8.1	**Daylight & Views,** Daylight 75% of Spaces	1
	1		Credit 8.2	**Daylight & Views,** Views for 90% of Spaces	1

Yes	?	No			
1	2		**Innovation & Design Process**		5 Points
	1		Credit 1.1	**Innovation in Design:** Green Design Education Component	1
	1		Credit 1.2	**Innovation in Design:** Medicinal Herb Garden	1
			Credit 1.3	**Innovation in Design:** Provide Specific Title	1
			Credit 1.4	**Innovation in Design:** Provide Specific Title	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
33	15	13	**Project Totals** (pre-certification estimates)	69 Points

Certified: 26-32 points, **Silver:** 33-38 points, **Gold:** 39-51 points, **Platinum:** 52-69 points

1.1

SECTION 02 01 00

EXISTING UTILITES AND STRUCTURES

PART 2 - GENERAL

2.1 RELATED DOCUMENTS

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

2.2 SUMMARY

A. This Section includes protecting and coordinating with existing utilities and underground structures.

2.3 DESCRIPTION

A. The existing utilities and underground structures shown on the drawings are shown diagrammatically and it is not to be inferred that the locations shown are precise.

B. The Contractor shall coordinate with all applicable utility owners prior to excavation in areas where it is reasonable to expect the presence of existing utilities, whether shown on the drawings or not.

C. Contractor to coordinate with a utility locator service provider to locate underground utilities before the start of construction.

D. The Contractor shall be responsible to pay for any and all damages to any existing utilities and underground structures, caused by his efforts. The utility shall make the determination as to who makes the necessary repairs.

E. If any such damage should occur the Contractor shall contact the effected utility and the Owner's Representative immediately.

F. In areas where existing underground structures are shown or suspected carefully uncover such structures to such extent as to enable the Owner's Representative to determine what adjustments if any need to be made to accommodate the presence or removal of such structure.

2.4 UTILITIES

A. Arrange for disconnecting and sealing indicated utilities that serve existing structures before site excavation, demolition and clearing.

B. Locate, identify, disconnect, and seal or cap off utilities.

1. Arrange with utility providers to shut off appropriate utilities.

C. Provide notification to Owner's Representative and utility provider five days prior to any interruption of service. Do not proceed without receiving written authorization to do so.

D. Arrange to provide temporary utility services if indicated or deemed necessary by the Owner or the utility provider.

E. Excavate, remove, and backfill underground utilities to be removed.

F. Excavate, cap and seal, and backfill underground utilities to be abandon in place.

PART 3 - PRODUCTS (Not Used)

PART 4 - EXECUTION (Not Used)

END OF SECTION

SECTION 02 32 00

GEOTECHNICAL INVESTIGATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section refers to the geotechnical investigations and report as prepared by Haley & Aldrich, Inc. dated November 2, 2007.

1.3 DESCRIPTION

A. Subsurface explorations have been done at the location of the project and soils reports have been compiled for the purpose of guidance in the design of the project facilities.

B. The logs are not intended to indicate subsurface conditions except at the locations of the exploration (at the time explorations were made) and any interpretation the Contractor may make is his responsibility.

C. The subsurface investigations of the site were made in conjunction with design of the facility to be constructed under this Contract. Portions of this investigation are presented in said report which is a part of the Contract Documents. The report presents the opinion of the Geotechnical Engineer and shall not be interpreted to prescribe or dictate construction procedures or relieve the Contractor in any way of his responsibility for the construction.

D. The water levels shown on the log at the exploration locations are based on observations made by the Field personnel at the same time the explorations were made and may not represent the groundwater surface at other times of year or in the immediate vicinity of the explorations. They are presented only as an observation of the free-standing water surface in the exploration on the date noted.

E. The refusal depths shown at the exploration locations indicate only, that in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impractical by the procedures and equipment being used. Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man- made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 02 41 13

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities as indicated.
4. Salvaging items for reuse by Owner.

B. Related Sections include the following:

1. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

A. Demolish: Completely remove and legally dispose of off-site.

B. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.

C. Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

C. All items indicated on the drawings to be "Salvage" shall remain the property of the Owner and stored and delivered per direction of Owner's Representative.

1.5 SUBMITTALS

A. Schedule of Site Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping of utility services.

B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

1.7 PROJECT CONDITIONS

A. Conduct site demolition so operations of adjacent occupied buildings will not be disrupted.

1. Provide not less than 5 days notice of activities that will affect operations of adjacent buildings or facilities.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

    a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction and Owner's Representative.

B. Owner assumes no responsibility for building structures and utilities to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered by the Contractor, do not disturb; immediately notify the Owner's Representative for review of situation and development of remedial action required.

D. On-site storage of removed items or materials is not permitted without the permission of the Owner's Representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

D. Verify that hazardous materials have been remediated before proceeding with site demolition operations.

3.2 PREPARATION

A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings, structures, and utilities to be demolished.

1. Contractor to coordinate all work and interruptions of service on site utilities with Owner, municipalities and utility providers.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

B. Existing Utilities: Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

C. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area indicated on Drawings or as directed by the Owner's Representative.
5. Protect items from damage during transport and storage.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings at all times.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner's Representative and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner's Representative and authorities having jurisdiction.

    a. Provide at least 5 days notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated existing buildings, site structures, and site improvements completely or to the limits indicated on the drawings. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 8 hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Explosives of any kind are not permitted on the site without written permission from Owner's Representative.

D. Salvage: Items to be salvaged are indicated on Drawings.

E. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet (1.5 m) outside footprint indicated for new construction. Abandon below-grade construction outside this area.
1. Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.

F. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet (1.5 m) outside footprint indicated for new construction. Abandon utilities outside this area.

1. Fill abandoned utility structures with acceptable soil materials placed according to backfill requirements in Division 31 Section "Earth Moving."

G. Demolish and remove existing utilities and below-grade utility structures.

1. Fill abandoned utility structures with acceptable soil materials placed according to backfill requirements in Division 31 Section "Earth Moving."

3.5 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with acceptable materials placed according to backfill requirements in Division 31 Section "Earth Moving."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.6 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION

SECTION 033000 – CAST -IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section and, without limiting the generality thereof, furnish and include the following:

1. The extent of cast-in-place concrete work is shown on drawings and includes (but not by way of limitation) formwork, reinforcing, cast-in-place concrete, accessories, finishing, and casting in of items specified under other Sections of the Specifications or furnished by Owner that are required to be built-in with the concrete.

2. Equipment support pads indicated on mechanical drawings to be installed by the Building Contractor.

3. Cast-in-place retaining walls, exterior slabs on grade and other concrete shown on site drawings.

1.03 RELATED WORK:

A. Metal Fabrications: Section 05500

1. Expansion Anchors - Section 05120

2. Embedded Items - Section 05500

B. Anchor Bolts: Section 05120

C. Joint Sealants: Section 07900

D. Underslab Vapor Retarders/Wall Waterproofing: Division 7

1.04 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the latest edition of the following except where more stringent requirements are shown or specified:

1. ACI "Manual of Concrete Practice".
2. ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials".
3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."
4. ACI 212.3R "Chemical Admixtures for Concrete."
5. ACI 301 "Specifications for Structural Concrete for Buildings."
6. ACI 302.1R "Guide for Concrete Floor and Slab Construction."
7. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete."
8. ACI 304.2R "Placing Concrete by Pumping Methods."
9. ACI 306 R "Cold Weather Concreting."
10. ACI 308 "Standard Practice for Curing Concrete."
11. ACI 309R "Guide for Consolidation of Concrete."
12. ACI 315 "ACI Detailing Manual."
13. ACI 318 "Building Code Requirements for Reinforced Concrete."
14. ACI 347R "Guide to Formwork for Concrete."
15. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."
16. AISC "Code of Standard Practice for Steel Buildings and Bridges."
17. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

1.05 SUBMITTALS:

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Reinforcement certified mill reports covering chemical and physical properties and yield strength.

2. Patching products.

3. Non-shrink grout.

4. Curing compounds, where applicable.

5. Admixtures.

6. Expansion/Adhesive Anchors.

H. Shop Drawings:

1. Shop Drawing Preparation: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings is prohibited. Shop drawings created from reproduced Construction Documents will be returned without review. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315, showing bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete elements. Include supplemental reinforcing and bar supports necessary to support reinforcing steel at proper location within forms or slabs.

    a. Review of the shop drawings will be made for the size and arrangement of reinforcement. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. **Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**

    b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided all items listed prior. **Incomplete submittals will not be reviewed.**

I. Mix designs: Submit all laboratory test reports and materials for each mix design listed within. Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include the calculation of average strength and standard deviation. Proportioning by water cement ratio method will not be permitted.

J. LEED Documentation: Refer to paragraph 1.06 of this section and Section 01352.

K. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.

L. Curing Methods: Submit documentation of curing methods to be used for review. Account for anticipated project temperature ranges and conditions in curing methods.

M. Contraction/Construction Joints: Submit plan indicating proposed location of contraction and construction joints in walls and slabs.

N. Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

1.06 LEED Requirements

A. Material Recycled Content: Slag or Fly Ash Cement Replacement

1. Blast Furnace Slag: Granulated blast furnace slag conforming to ASTM C989, included in the calculation of water-cementitious materials, and shall be included in the concrete mix. The weight of granulated blast-furnace slag shall be 40 percent of cementitious materials. The slag used in the manufacture of a Type IS or ISM blended hydraulic cement conforming to ASTM C595 shall be included in the calculated percentage.

2. Fly Ash: As an alternate to Blast Furnace Slag, Fly Ash and pozzolan conforming to ASTM C618, included in the calculation of water-cementitious materials, shall be included in the concrete mix. If used the Fly ash shall be included in the percentages prescribed above. The fly ash and pozzolan present in ASTM Type IP or IPM blended cement, conforming to ASTM C595, shall be included in the calculated percentage.

3. Concrete mix designs shall indicate the cement replacement percentages.

4. Substitution of 4,000 psi concrete for 3,000 psi concrete is not acceptable.

B. Material Recycled Content: Concrete Reinforcing Steel

1. Post-consumer recycled content: 50%

2. The sum of the post industrial and post consumer recycled content:60%

3. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.

C. Local/Regional Materials: Ready-mix concrete supplier shall be located within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of the building site.

D. Local/Regional Materials: Concrete reinforcement fabrication shall be located within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of the building site.

E. Low emitting adhesives and sealants: Provide water-based, biodegradable form coating with maximum VOC content of 55 grams/liter. Provide cut sheet and/or material safety data sheet for form coating with VOC levels highlighted.

F. Waste Management:

1. Before concrete pours, designate locations or uses for excess concrete. Options include the following:

a. Additional paving.

b. Post footing anchorage.

c. Swale, riprap reinforcing.

d. Flowable fill.

e. Footing bottom, retaining wall footing ballast.

f. Storm structure covers.

g. Underground utility pipe kickers.

h. Storm pipe flared end section.

i. Toe wash protection, and shoulder and toe outfall restraints for temporary erosion pipes.

2. Before concrete pours, designate a location for cleaning out concrete trucks. Options include the following:

a. Company-owned site for that purpose (meeting environmental standards).

b. On-site area to be paved later in Project.

3. Collect waste reinforcing steel and place in designated area for recycling.

PART 2 PRODUCTS

2.01 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. Provide welded wire fabric in flat sheets.

C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use plastic, wire bar type supports or concrete block supports complying with CRSI recommendations, unless otherwise specified. Wood, clay brick and other unspecified devices are not acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).

2.03 CONCRETE MATERIALS:

A. Single-Source Supplier: Ready-mix concrete shall be from one supplier unless specific written approval is received from the Structural Engineer.

B. Portland Cement: ASTM C 150, Type I or Type II, unless otherwise approved Use one brand of cement throughout project, unless otherwise acceptable to Architect.

C. Normal Weight Aggregates: ASTM C 33. Provide from a single source for exposed concrete. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, or ochre which can cause stains on exposed concrete surfaces.

D. Light Weight Aggregates: ASTM C 330.

E. Water: Potable.

F. Air-Entraining Admixture: ASTM C 260.

G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G containing not more than 1% chloride ions.

H. Fiber reinforcement shall be Type III Synthetic Virgin Homopolymer Polypropylene Fibers conforming to ASTM C1116. Fiber reinforcing shall be added and distributed prior to incorporation of Super Plasticizer.

I. Normal range water reducing admixture: ASTM C 494 Type A containing no calcium chloride.

J. Accelerating Admixture: ASTM C 494, Type C or E.

K. Blast Furnace Slag: ASTM C989

L. Fly Ash: ASTM C618, Class C or F

M. Calcium Chloride is not permitted.

2.04 RELATED MATERIALS:

A. Underslab Vapor Retarder: Provide vapor retarder over prepared sub base. Refer to architectural drawings, geotechnical report and/or division 7 specifications for additional requirements and vapor retarder location.

B. Non-Shrink Cement-based Grout: Provide grout consisting of pre-measured, prepackaged materials supplied by the manufacturer requiring only the addition of water. Manufacturer's instructions must be printed on the outside of each bag.

1. Non-shrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%) and a maximum of 0.2% expansion in the hardened state when tested in accordance with CRD-C-621.

2. Compressive strength: A minimum 28 day compressive strength of 5000 psi when tested in accordance with ASTM C-109.

3. Setting time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.

4. Composition: Shall not contain metallic particles or expansive cement.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171.

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

E. Liquid Membrane-Forming Curing Compound: Liquid type membrane forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Curing compound shall not impair bonding of any material, including floor finishes, to be applied directly to the concrete. Demonstrate the non-impairment prior to use.

F. Preformed Expansion Joint Formers:

1. Bituminous Fiber Type, ASTM D 1751.

2. Felt Void, Poly-Styrene Cap with removable top as manufactured by SUPERIOR.

G. Slab Joint Filler: Multi-component polyurethane sealant (self-leveling type).

H. Waterstops shall be PVC. Acceptable products include:

Greenstreak

2.05 PROPORTIONING AND DESIGN OF MIXES:

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318. Use material, including all admixtures, proposed for use on the project. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

B. Submit written reports to Architect of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been reviewed by Architect.

C. Proportion design mixes to provide concrete with the following properties:

1. Footings and foundation walls

a. Strength: 3000 psi at 28 days.

b. Aggregate: 3/4"

c. W/C Ratio: 0.54 maximum

d. Entrained Air: 6% +/- 1.5%

e. Slump: 4" maximum

2. Interior Slabs on grade and elevated slabs:

a. Strength: 3000 psi at 28 days

b. Aggregate: 3/4" minimum, 1 1/2" maximum.

c. W/C Ratio: 0.54 maximum

d. Entrapped Air only (no entrainment), 2% maximum

e. Slump: 4" maximum

3. Exterior Slabs and all other exposed Site Concrete not specified elsewhere:

a. Strength: 4500 psi at 28 days

b. Aggregate: 3/4"

c. W/C Ratio: 0.45 maximum

d. Entrained Air: 6% +/- 1.5%

e. Slump: 4" maximum

4. Add air entraining admixture at manufacturers prescribed rate to result in concrete at point of placement having the above noted air contents.

5. Additional slump may be achieved by the addition of a mid-range or high-range water reducing admixture. Maximum slump after the addition of admixture shall be 6 or 8 inches for mid-range or high range water reducing admixtures, respectively.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor, when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Structural Engineer before using in work.

1. Water may be added at the project only if the maximum specified slump and design mix maximum water/cement ratio is not exceeded.

2. Additional dosages of superplastisizer should be used when delays occur and required slump has not been maintained. A maximum of two additional dosages will be permitted per ACI 212.3R recommendations.

2.06 CONCRETE MIXING:

A. Job-Site Mixing will not be permitted.

B. Ready-Mix Concrete: Must comply with the requirements of ASTM C 94, and as herein specified. Provide batch ticket for each batch discharged and used in work, indicating project name, mix type, mix time and quantity.

1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required by Structural Engineer.

2. When the air temperature is between 85 degrees F. and 90 degrees F., reduce the mixing and delivery time from 1 1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F., reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMS:

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design, construct, erect, maintain, and remove forms for cast-in-place concrete work in compliance with ACI 347.

C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, dovetail slots, reglets, recesses, and the like to prevent swelling and for easy removal.

F. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

G. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

H. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise indicated, provide ties for concrete surfaces to be exposed to view in the final condition so portion remaining within concrete after removal is 1" (minimum) inside concrete.

2. Form ties shall not leave holes larger than 1" diameter in concrete surface. Repair holes left by form ties after removal of formwork.

I. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

J. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT:

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

1. Subgrade tolerance shall conform to a tolerance of +0/-1 1/2". Base tolerance (fine grading) for slabs shall conform to a tolerance of +0"/-3/4" in. Confirm compliance of above tolerances with surveyed measurements taken at 20 ft. intervals in each direction.

2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

3. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

4. Place reinforcement to obtain specified coverage for concrete protection within tolerances of ACI-318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

5. Install welded wire fabric in flat sheets in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.03 JOINTS:

A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect. Submit plan indicating proposed location of construction joints for review prior to beginning work.

1. Provide keyways at least 1-1/2" deep in construction joints in walls, and slabs; bulkheads reviewed by the Engineer, designed for this purpose may be used for slabs.

2. Roughened surfaces shall be used between walls and footings unless shown otherwise on the drawings. The footing surface shall be roughened to at least an amplitude of 1/4" for the width of the wall before placing the wall concrete.

3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

4. Joints in slabs on grade shall be located and detailed as indicated on the drawings. If saw-cut joints are required, the early-entry dry-cut process shall be used. Refer to ACI 302, section 8.3.12.

3.04 INSTALLATION OF EMBEDDED ITEMS:

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto. Notify other trades to permit installation of their work. Templates to be utilized for setting of anchorage devices shall be constructed in a manner to allow mechanical consolidation of concrete. "Wet Setting" of embedded items into plastic concrete will not be permitted without special permission from the Engineer.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface.

C. Provide PVC sleeves where pipes and/or conduit pass through exterior concrete or slabs. Sleeves or penetrations shall not be placed through footings, piers, pedestals, drop caps, columns or pilasters unless specifically noted.

D. Tolerances: Tolerances for Anchor Bolts/Rods, bearing surfaces and other embedded items shall meet the requirement set forth in the latest edition of the American Institute of Steel Construction "Code of Standard Practice for Steel Buildings and Bridges," and ACI 117. The more stringent criteria from these documents shall apply.

3.05 INSTALLATION OF GROUT

A. Place grout for base plates in accordance with manufacturer's recommendations.

B. Grout below setting plates as soon as practicable to facilitate erection of steel and prior to removal of temporary bracing and guys. If leveling bolts or shims are used for erection grout shall be installed prior to addition of any column load.

C. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

3.06 PREPARATION OF FORM SURFACES:

A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating material manufacturer's directions. Do not allow excess form coating to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.07 CONCRETE PLACEMENT:

A. Preplacement Review: Footing bottoms are subject to review by the Geotechnical Engineer. Reinforcement and all concrete preparation work shall be subject to review by the Structural Engineer. Verify that reinforcing, ducts, anchors, seats, plates and other items cast into concrete are placed and securely held. Notify Engineer/Project Special Inspector 48 hours prior to scheduled placement and obtain approval or waiver of review prior to placement. Be sure that all debris and foreign matter is removed from forms.

B. Concrete shall be placed in the presence of an approved testing agency.

C. General: Comply with ACI 304, and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.

2. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.

3. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:

a. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.

b. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long, and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

c. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete.

d. Concrete shall not be conveyed through pipe made of aluminum alloy. Standby equipment shall be provided on the site.

e. Tined rakes are prohibited as a means of conveying fiber reinforced concrete.

4. Do not use reinforcement as bases for runways for concrete conveying equipment or other construction loads.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment. Hand-spading, rodding or tamping as the sole means for the consolidation of concrete will only be permitted with special permission from the Engineer. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

2. Use vibrators designed to operate with vibratory equipment submerged in concrete, maintaining a speed of not less than 8000 impulses per minute and of sufficient amplitude to consolidate the concrete effectively. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine, generally at points 18 inches maximum apart. Place vibrators to rapidly penetrate placed layer and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion maintain the duration of vibration for the time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operation.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete using internal vibrators during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Do not sprinkle water on plastic surface.

3. Maintain reinforcing in proper position during concrete placement operations.

4. Slab thicknesses indicated on the drawings are minimums. Provide sufficient concrete to account for structure deflection, subgrade fluctuations, and to obtain the specified slab elevation at the flatness and levelness indicated here within.

5. Finish: See "Monolithic Slab Finishes" in this specification for slab finish requirements.

F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27degrees C) at point of placement.

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 and other materials containing antifreeze agents or chemical accelerators.

4. All temporary heat, form insulation, insulated blankets, coverings, hay or other equipment and materials necessary to protect the concrete work from physical damage caused by frost , freezing action, or low temperature shall be provided prior to start of placing operations.

5. When the air temperature has fallen to or is expected to fall below 40 degrees F, provide adequate means to maintain the temperature in the area where concrete is being placed between 50 and 70 degrees F.

G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Wet forms thoroughly before placing concrete.

4. Do not use retarding admixtures without the written acceptance by the Architect.

3.08 FINISH OF FORMED SURFACES:

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This concrete surface shall have texture imparted by form facing material, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 in. in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This as-cast concrete surface shall be obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment. Combine one part Portland cement to 1-1/2 parts fine sand by volume and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

1. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

D. Related Unformed Surfaces: At tops of walls and grade beams, horizontal offset surfaces occurring adjacent to formed surfaces, strike-off, smooth and finish with a texture matching adjacent uniformed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.09 FLOOR FLATNESS AND LEVELNESS

A. Floor flatness/levelness tolerances: Tolerances for various floor uses shall conform to the requirements set forth in ACI 117 and ACI 302 for "flat" floor profile.

1. Minimum Test Area Flatness/Levelness: F_F30/F_L20

2. Minimum Local F Number: F_F15/F_L10

B. Levelness criteria shall be applied to slabs-on-grade only.

C. Contractor shall measure floor finish within 72 hours after slab finishing and provide corrective measures for finishes not within tolerance. Corrective procedures shall be reviewed by the Architect prior to implementation.

3.10 MONOLITHIC SLAB FINISHES:

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds, and as otherwise indicated.

1. After placing slabs, plane surface to a tolerance not exceeding 1/2 in. in 10 ft. when tested with a 10-ft. straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms or rakes.

B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, and as otherwise indicated.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces indicated, including slab surfaces to be covered with carpet, resilient flooring, paint or other thin-film finish coating system.

D. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

E. Slab finishes for floor coverings not indicated or exposed to view in the final condition shall be coordinated with the Architect prior to slab placement.

F. Slab Joints: Where indicated, sawn slab contraction joints shall be "soft cut", immediately after concrete surface is firm enough not to be torn or damaged by the blade.

3.11 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 308 as herein specified.

B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified unless noted otherwise. Curing shall commence as soon as concrete surfaces are sufficiently hard as to withstand surface damage. Slabs-on-grade shall be cured by moist curing methods.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Protection From Mechanical Injury: During the curing period and duration of construction, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

3.12 REMOVAL OF FORMS:

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as joints, slabs and other structural elements, may not be removed in fewer than 14 days or until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and support.

3.13 REUSE OF FORMS:

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and latency, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.14 MISCELLANEOUS CONCRETE ITEMS:

A. Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

3.15 CONCRETE SURFACE REPAIRS:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Architect.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, form tie holes, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, and other projections on surface and stains and other discolorations that cannot be removed by cleaning.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. Testing Agency/Project Special Inspector shall verify reinforcement, including foundation reinforcement and slab reinforcement (WWF or reinforcing bar). Agent shall verify WWF or reinforcement has been chair/placed with proper clearances.

B. The Owner shall employ a Testing Laboratory to inspect, sample and test the materials and the production of concrete and to submit test reports. Concrete testing shall be performed by technicians certified by the Maine Concrete Technician Certification Board and/or ACI Concrete Field Testing Technician Grade I.

C. Concrete shall be sampled and tested for quality control during placement. Quality control testing shall include the following, unless otherwise directed by the Architect.

D. See Submittals section for report requirements.

E. Sampling Fresh Concrete: ASTM C 172.

1. Slump: ASTM C143; One test for each set of compressive strength test specimens. Sample shall be taken from middle third of the load per ASTM C172. A slump test must be run prior to the incorporation of the CFP fibers per recommendations of ACI 544. A slump test must be run prior to and following the addition of a water reducer (superplasticizer) per recommendations of ACI 301.

2. Air Content: ASTM C231 "Pressure method for normal weight concrete." one test for each set of compressive strength specimens measured at point of discharge.

3. Concrete Temperature: Per ASTM C-1064; one test each time a set of compression test specimens are made.

4. Compression Test Specimen: ASTM C31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

    a. An insulated Cure Box for specimen curing shall be supplied by Testing Agency for initial curing as defined in ACI C31.

    b. Means of heating or cooling the Cure Box shall be provided by the Inspection Agency if required in order to maintain a temperature between 60 and 80 degrees F. Contractor shall provide an electrical source to the Testing Agency when required for temperature control.

    c. A maximum-minimum thermometer shall be provided in the Cure Box by the Testing Agency to record the temperature range of the Cure Box during specimen curing. The Testing Agency shall record the maximum/minimum temperature of the Cure Box when transferring the specimens to the laboratory.

    d. Test Specimens shall be moist cured.

    e. Refer to ACI C31 for additional requirements for Test Specimens.

5. Compressive Strength Tests: ASTM C39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 4,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, 1 specimen retained in reserve for later testing if required.

6. Pumped concrete shall be tested at point of discharge per ACI 301.

F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods, as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
LEED MR Credit 5.1 – This credit requires that a minimum of 10% (based on cost) of building materials and products used in this project have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.
LEED MR Credit 5.2 – This credit requires that a minimum of 20% (based on cost) of building materials and products used in this project have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.

1.2 SUMMARY

A. This Section includes the following:

1. Architectural precast concrete cladding units.

B. Related Sections include the following:
1. Division 01 Section "Sustainable Design Requirements"
2. Division 03 Section "Cast-in-Place Concrete" for installing connection anchors in concrete.
3. Division 04 Section "Unit Masonry" for thin brick setting materials and installation after precast concrete panel production.
4. Division 05 Section "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.

1.3 DEFINITION

A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Loads: As indicated.
2. Wind Loads: See Drawing
3. Seismic Loads: See Drawing.
4. Design framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:

   a. Upward and downward movement of 1/2 inch (13 mm).

5. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F (67 deg C).

1.5 SUBMITTALS

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

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

C. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.

1. Indicate separate face and backup mixture locations and thicknesses.
2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
4. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
5. Include plans and elevations showing unit location and sequence of erection for special conditions.
6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
7. Indicate relationship of architectural precast concrete units to adjacent materials.
8. Indicate locations and details of brick units, including corner units and special shapes, and joint treatment.
9. Indicate locations and details of stone facings, anchors, and joint widths.

10. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
11. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

D. Samples: For each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).

1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
2. Samples for each brick unit required, showing full range of color and texture expected. Include Sample showing color and texture of joint treatment.

E. Welding certificates.

F. Qualification Data: For fabricator.

G. Material Test Reports: For aggregates.

H. Material Certificates: For the following items, signed by manufacturers:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Structural-steel shapes and hollow structural sections.
6. Brick units and accessories.
7. Stone anchors.

I. Source quality-control test reports.

J. Field quality-control test and special inspection reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project before erection of precast concrete and who can produce an Erectors' Post-Audit Declaration.

B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Participates in PCI's plant certification program and is designated a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units.

C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

F. Welding: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."

G. Mockups: After sample panel approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup as indicated on Drawings including sealants and architectural precast concrete complete with anchors, connections, flashings, and joint fillers.
2. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Architect in writing.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground.

B. Support units during shipment on nonstaining shock-absorbing material.

C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

D. Place stored units so identification marks are clearly visible, and units can be inspected.

E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.

F. Lift and support units only at designated points shown on Shop Drawings.

1.8 SEQUENCING

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

B. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized.

D. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) ASTM A 706/A 706M, deformed bars, ASTM A 775/A 775M epoxy coated.

E. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.

F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from galvanized steel wire into flat sheets.

G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

H. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain, flat sheet, Type 1 bendable coating.

I. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.3 PRESTRESSING TENDONS

A. Prestressing Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand.

1. Coat unbonded post-tensioning strand with corrosion inhibitor passing ASTM D 1743 and sheath with polypropylene tendon sheathing. Include anchorage devices and coupler assemblies.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin Admixture: ASTM C 618, Class N.
3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.

D. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C 330, with absorption less than 11 percent.

E. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017 M.

2.5 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

C. Carbon-Steel Plate: ASTM A 283/A 283M.

D. Malleable Iron Castings: ASTM A 47/A 47M.

E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

G. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.

H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.

K. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M).

L. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.

1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

M. Welding Electrodes: Comply with AWS standards.

2.6 BEARING PADS

A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO's "AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Division II, Section 18.10.2, or with MIL-C-882E.
4. Frictionless Pads: Tetrafluoroethylene (Teflon), glass-fiber reinforced, bonded to stainless or mild-steel plate, of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.7 ACCESSORIES

A. Reglets: Specified in Division 07 Section "Sheet Metal Flashing and Trim."

B. Reglets: PVC extrusions felt or fiber filled, or with face opening of slots covered.

C. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.8 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144, or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.9 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Limit use of fly ash and silica fume to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.10 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly radiused unless otherwise indicated.

2.11 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcement to maintain at least 3/4-inch (19-mm) minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.

G. Prestress tendons for architectural precast concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 117.

1. Delay detensioning or post-tensioning of precast, prestressed architectural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.

H. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

L. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

M. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.

N. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

O. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.12 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:

1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:

    a. 10 feet (3 m) or under, plus or minus 1/8 inch (3 mm).
    b. 10 to 20 feet (3 to 6 m), plus 1/8 inch (3 mm), minus 3/16 inch (5 mm).
    c. 20 to 40 feet (6 to 12 m), plus or minus 1/4 inch (6 mm).
    d. Each additional 10 feet (3 m), plus or minus 1/16 inch (1.5 mm).

2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:

    a. 10 feet (3 m) or under, plus or minus 1/4 inch (6 mm).
    b. 10 to 20 feet (3 to 6 m), plus 1/4 inch (6 mm), minus 3/8 inch (10 mm).
    c. 20 to 40 feet (6 to 12 m), plus or minus 3/8 inch (10 mm).
    d. Each additional 10 feet (3 m), plus or minus 1/8 inch (3 mm).

3. Total Thickness or Flange Thickness: Plus 1/4 inch (6 mm), minus 1/8 inch (3 mm).
4. Rib Thickness: Plus or minus 1/8 inch (3 mm).
5. Rib to Edge of Flange: Plus or minus 1/8 inch (3 mm).
6. Distance between Ribs: Plus or minus 1/8 inch (3 mm).
7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches (3 mm per 1830 mm) or 1/2 inch (13 mm) total, whichever is greater.
8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch (6 mm).
9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch (19 mm).
10. Dimensions of Haunches: Plus or minus 1/4 inch (6 mm).
11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch (3 mm).
12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch (6 mm).
13. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
14. Local Smoothness: 1/4 inch per 10 feet (6 mm per 3 m).
15. Warping: 1/16 inch per 12 inches (1.5 mm per 300 mm) of distance from nearest adjacent corner.
16. Tipping and Flushness of Plates: Plus or minus 1/4 inch (6 mm).
17. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch (3 mm).

C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.

1. Weld Plates: Plus or minus 1 inch (25 mm).
2. Inserts: Plus or minus 1/2 inch (13 mm).
3. Handling Devices: Plus or minus 3 inches (75 mm).
4. Reinforcing Steel and Welded Wire Fabric: Plus or minus 1/4 inch (6 mm) where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch (13 mm).
5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch (13 mm) of plan dimensions.
6. Tendons: Plus or minus 1/4 inch (6 mm), vertical; plus or minus 1 inch (25 mm), horizontal.
7. Location of Rustication Joints: Plus or minus 1/8 inch (3 mm).
8. Location of Opening within Panel: Plus or minus 1/4 inch (6 mm).
9. Location of Flashing Reglets: Plus or minus 1/4 inch (6 mm).
10. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch (3 mm).
11. Reglets for Glazing Gaskets: Plus or minus 1/8 inch (3 mm).
12. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch (13 mm).
13. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch (6 mm).
14. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch (6 mm) maximum over the full dimension of unit.
15. Position of Sleeve: Plus or minus 1/2 inch (13 mm).
16. Location of Window Washer Track or Buttons: Plus or minus 1/8 inch (3 mm).

2.13 FINISHES

A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and as follows:
   1. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.
   2. As-Cast Surface Finish: Provide surfaces free of pockets, sand streaks, and honeycombs.

B. Finish exposed top bottom and back surfaces of architectural precast concrete units to match face-surface finish.

C. Finish unexposed surfaces of architectural precast concrete units by float finish.

2.14 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

B. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.

   1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing

agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

C. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.

D. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.

1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
2. Cores will be tested in an air-dry condition.
3. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
4. Test results will be made in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:

    a. Project identification name and number.
    b. Date when tests were performed.
    c. Name of precast concrete fabricator.
    d. Name of concrete testing agency.
    e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting cast-in-place building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is complete.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.

1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch (19 mm).

C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
4. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
5. Remove, reweld, or repair incomplete and defective welds.

E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.

F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

B. Erect architectural precast concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances:

1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch (13 mm).
2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch (13 mm).
3. Top Elevation from Nominal Top Elevation: As follows:

    a. Exposed Individual Panel: Plus or minus 1/4 inch (6 mm).
    b. Non-Exposed Individual Panel: Plus or minus 1/2 inch (13 mm).
    c. Exposed Panel Relative to Adjacent Panel: 1/4 inch (6 mm).
    d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch (13 mm).

4. Support Elevation from Nominal Support Elevation: As follows:

    a. Maximum Low: 1/2 inch (13 mm).
    b. Maximum High: 1/4 inch (6 mm).

5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet (30 m): 1 inch (25 mm).
6. Plumb in Any 10 Feet (3 m) of Element Height: 1/4 inch (6 mm).
7. Maximum Jog in Alignment of Matching Edges: 1/4 inch (6 mm).
8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch (6 mm).
9. Maximum Joint Taper: 3/8 inch (10 mm).
10. Joint Taper in 10 Feet (3 m): 1/4 inch (6 mm).
11. Maximum Jog in Alignment of Matching Faces: 1/4 inch (6 mm).
12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch (6 mm).
13. Opening Height between Spandrels: Plus or minus 1/4 inch (6 mm).

C. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

D. Field welds will be subject to visual inspections and nondestructive testing according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.

E. Testing agency will report test results promptly and in writing to Contractor and Architect.

F. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

G. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Face brick.
3. Building (common) brick.
4. Exterior Tile and mortar for the tile.

B. See Division 1 Section Sustainable Design Requirements

C. See Division 05 Section "Metal Fabrications" for furnishing steel lintels for unit masonry.

D. See Division 07 Section "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints for metal flashing.

E. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

i. LEED MR Credit 2.1 – Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
ii. LEED MR Credit 2.2 – Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (referenced above) for a total of at least 75% of non-hazardous construction and demolition debris.
iii. LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
iv. LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
v. LEED MR Credit 5.1 – This credit requires that a minimum of 10% (based on cost) of building materials and products used in this project have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.
vi. LEED MR Credit 5.2 – This credit requires that a minimum of 20% (based on cost) of building materials and products used in this project have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site.
vii. LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management

District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.2 SUBMITTALS

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

B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement.

C. Samples for each type and color of exposed masonry units and colored mortars.

D. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.

1. For masonry units include material test reports substantiating compliance with requirements.

E. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

F. LEED-Required Submittals per Division 1 Section 018113.

1.3 QUALITY ASSURANCE

A. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner.

1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
3. Mortar Test (Property Specification): For each mix required, per ASTM C 780 .
4. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.

B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

C. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.

1. Build sample panels for typical exterior wall including in sizes approximately 48 inches (1200 mm) long.

1.4 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. 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.

2.2 COLORS, TEXTURES, AND PATTERNS

A. Exposed Masonry Units: As selected from manufacturer's full range.

2.3 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa) unless stated otherwise in Drawings.
2. Provide CMU as indicated on the drawings for the stair and elevator shafts
3. The brick ties are HB X-seal http://www.h-b.com/products/view/details/X-SEAL or architect approved equal.

2.4 CONCRETE AND MASONRY LINTELS

A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.

B. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

2.5 BRICK

General: Provide shapes indicated and as follows: Westbrook Brick or approved equal brick There will be special brick shapes – see drawings.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade SW.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa).
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
5. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.
6. Bricks with frogs are not allowed.
7. Provide shaped bricks as indicated on drawings.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

B. Hydrated Lime: ASTM C 207, Type S.

C. Masonry Cement: ASTM C 91.

1. Available Products:

a. Capital Materials Corporation; Flamingo Color Masonry Cement.
b. Essroc, Italcementi Group; Brixment or Velvet.
c. Lafarge North America Inc.; Magnolia Masonry Cement Lafarge Masonry Cement Trinity White Masonry Type N.
d. Lehigh Cement Company; Lehigh Masonry Cement Lehigh White Masonry Cement.
e. National Cement Company, Inc.; Coosa Masonry Cement.

D. Mortar Pigments: Iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Available Products:

a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.

E. Aggregate for Mortar: ASTM C 144.

1. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

G. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Available Products:

a. Addiment Incorporated; Mortar Kick.
b. Euclid Chemical Company (The); Accelguard 80.
c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
d. Sonneborn, Div. of ChemRex; Trimix-NCA.

I. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement: ASTM A 951; mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

1. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
2. Wire Size for Cross Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
3. Wire Size for Veneer Ties: W2.8 or 0.188-inch (4.8-mm) diameter.
4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
5. Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
6. Multiwythe Masonry:

a. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod at each wythe of masonry 4 inches (100 mm) or less in width.

7. Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm) diameter, hot-dip galvanized, carbon-steel continuous wire.

2.8 TIES AND ANCHORS

A. Materials:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
   1) Individual Wire Ties: The Brick ties are HB X-Seal Anchor System by Hohmann & Barnard, Inc. or architectural approved equal.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with Division 07 Section "Sheet Metal Flashing and Trim."

1. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees.
2. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
3. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

B. Flexible Flashing: For flashing not exposed to the exterior, use the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. (2-kg/sq. m) copper sheet bonded with asphalt between 2 layers of glass-fiber cloth.

   a. Available Products:

      1) Advanced Building Products Inc.; Copper Fabric Flashing.
      2) AFCO Products Inc.; Copper Fabric.
      3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
      4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
      5) Polytite Manufacturing Corp.; Copper Fabric Flashing.
      6) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
      7) York Manufacturing, Inc.; York Copper Fabric Flashing.

2. Rubberized-Asphalt Flashing: Not allowed.

3. EPDM Flashing: Not allowed.

C. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer.

2.10 EXTERIOR TILE AND MORTOR

A. The exterior tile:

1. Manufacturer: RAGNO USA; www.ragnousa.com

2. Product: (T-2) Lastricato Porfido R

B. Mortar for the exterior tile: Pro Superpoxy 2 (http://www.ai-qa.com/proma/products.php?id=15) or architect and manufacturer approved equal.

2.11 CONCEALED FLASHING

A. Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above. For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:
1. Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of 7-oz./sq.ft. (2-kg/sq.m) sheet copper bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
a. Provide flashing as a complete system with preformed corners, end dams, other special shapes, and seaming materials; all produced by flashing sheet manufacturer.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene or urethane.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use the following, unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

a. Available Products:

1) Advanced Building Products Inc.; Mortar Maze weep vent.
2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
3) Heckmann Building Products Inc.; No. 85 Cell Vent.
4) Hohmann & Barnard, Inc.; Quadro-Vent.
5) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide one of the following configurations:

a. Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep.
b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
c. Sheets or strips full depth of cavity and installed to full height of cavity.

2. Available Products:

a. Advanced Building Products Inc.; Mortar Break.
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.

2.13 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement by weight.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

D. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

3.2 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.3 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6- to 10-mm-) thick joints.
2. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.4 COMPOSITE MASONRY

A. Bond wythes of composite masonry together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.

B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide individual metal ties not more than 16 inches (406 mm) o.c.
2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
3. Provide rigid metal anchors not more than 24 inches (610 mm) o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.5 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
   b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.

D. Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing."

E. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit insulation between wall ties and other confining obstructions, with edges butted tightly. Press units firmly against inside wythe of masonry.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1/2 inch (13 mm) in width between masonry and structural member, unless otherwise indicated.
2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.8 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing and insulation to wall framing with metal fasteners of type indicated. Use two fasteners.
2. Embed connector sections and continuous wire in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. (0.33 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.9 EXTERIOR TILE AND MORTOR

A. Install per manufacturer's recommendations.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing as recommended by flashing manufacturer.
2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

3.11 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:

1. Payment for these services will be made by Owner.

C. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.

D. Clay Masonry Unit Test: For each type of unit provided, per ASTM C 67.

E. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.

F. Mortar Test (Property Specification): For each mix provided, per ASTM C 780 . Test mortar for mortar air content.

G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.12 CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Protect adjacent surfaces from contact with cleaner.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
2. Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 – STRUCTURAL STEEL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

B. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.

1.03 RELATED WORK

1. Section 05300 – Metal Deck

2. Section 05500 - Metal Fabrications

1.04 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following, except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges-March 7, 2000".

    a. Exclude the word "structural" in reference to the "Design Drawings" in section 3.1 of the Code.

2. AISC "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design", June 1, 1989 including "Commentary" and Supplements issued thereto. A

3. AISC *"Specifications for Structural Joints using ASTM A 325 or A 490 Bolts"* approved by the Research Council on Structural Connections of the Engineering Foundation.

4. AISC 341, "Seismic Provisions for Steel Buildings".

5. AWS D1.1 - 2004 "Structural Welding Code" - Steel.

6. AWS D1.3 - 2004 "Structural Welding Code" - Sheet Steel.

7. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."

8. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."

1. Provide certification that welders to be employed in work have satisfactorily passed AWS D1.1 qualification tests and maintained a current certification. Current certification and/or continuity log shall be submitted and be available in the field.

2. If re-certification of welders is required, retesting will be the Contractor's responsibility.

C. Fabricator Qualifications: Fabricator must be a member of the American Institute of Steel Construction (AISC), be certified for SBD – Conventional Steel Building Structures, STD – Standard for Steel Building Structures. Fabricator shall be certified at time of bidding and for duration of project.

1.05 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. INCOMPLETE SUBMITTALS WILL NOT BE REVIEWED.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel certified mill reports for each grade of steel covering chemical and physical properties and yield strengths.

2. High-strength bolts (each type), including nuts and washers.

3. Structural steel primer paint (where applicable).

4. Structural steel top coat paint (where applicable). (Refer to Section 09900.)

5. AWS D1.1 Welder certifications.

6. Expansion/Adhesive Anchors (coordinate with section 03300).

H. Fabricator's Quality Control Procedures: Fabricator shall submit their written procedural and quality control manuals, and evidence of periodic auditing of fabrication practices by an approved inspection Agency.

I. Fabricator's Certificate of Compliance: At completion of fabrication, fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the construction documents.

J. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.

a. Review of the shop drawings will be made for the size and arrangement of the members and strength of the connections. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. **Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**

b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings

indicating all members, braced frames, moment frames and connections. Incomplete submittals will not be reviewed.

2. Alternate Connection Design: Connections for all beam, column, braced frame, and moment connections not tabulated in the AISC "Manual of Steel Construction" (ASD or LRFD) have been designed and detailed in the drawings. Alternate connection design shall be allowed only with prior approval of the Structural Engineer. If such approval is granted, all redesigned connections shall be designed by the fabricator's engineer, registered in the State of Maine. Calculations for redesigned connections shall signed and sealed.

3. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of test conducted and test results.

4. LEED Documentation: Refer to paragraph 1.07 of this section and Section 01352.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Steel materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

1.07 LEED Requirements:

A. Material Recycled Content: Structural Steel shall be meet the following minimum recycled content:

1. Post-consumer recycled content: 50%

2. The sum of the post industrial and post consumer recycled content: 60%

3. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.

B. Local/Regional Materials: Hot rolled, milled shapes shall be produced within the continent of North America.

C. Local/Regional Materials: Structural steel fabricator shall be located within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of the building site.

D. Waste Management: Collect offcuts and scrap and place in designated areas for recycling.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Structural Steel Shapes, Plates and Bars (U.N.O): ASTM A 36 minimum, higher strength steel is acceptable.

B. Structural Steel Hot Rolled Wide Flange Shapes: ASTM A 992 Grade 50 (ASTM A572 Grade 50 with special requirements per AISC Technical Bulletin #3, dated March 1997)

C. Steel Tube: ASTM A 500, Grade B, Fy = 46 ksi.

D. Steel Pipe: ASTM A 53, Grade B.

E. Anchor Bolts: ASTM F1554, Grade 36 weldable steel, unless noted otherwise on drawings. Anchor rods that are to be exposed to weather, located in unheated enclosures, or in contact with pressure treated lumber shall be hot dipped galvanized. All anchor bolts shall be headed or double nutted. "J" or "L" type anchor bolts are not permitted.

F. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.

G. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325 or ASTM A490. Refer to drawings for diameter.

2. Direct tension indicator washers or bolts may be used at Contractor's option.

H. Steel Shear Studs: Headed type manufactured from steel conforming to ASTM A108 Grade C1015 by KSM or Nelson. Refer to Drawings for diameter and length.

I. Electrodes for Welding: E70XX and comply with AWS Codes with proper rod to produce optimum weld joint considering material, weld position and size of joint. All filler metal used for complete penetration groove welds shall have a minimum Charpy V Notch value of 20 ft-lbs. at 40 degrees F for enclosed and heated structures and 20 ft-lbs. at 0 degrees F for all other structures. Electrodes shall be compatible with steel of both connected elements.

J. Structural Steel Coatings shall be as specified in the Structural Steel Coatings section of this specification, and as specified in Division 9.

K. Steel Coatings for Exterior Exposed Steel: Except where indicated to be primed and painted, Hot Dipped Galvanized per ASTM A123/A123M (latest edition). Galvanizing shall be applied in a manner to provide Class C faying surfaces for slip critical connections. See Structural Steel Coatings section for additional requirements for galvanizing and painting.

L. Non Shrink Cement-Based Grout: See Section 03300

M. Drilled Anchors: Expansion and adhesive by HILTI, SIMPSON or POWERS/RAWL as indicated on the drawings.

2.02 FABRICATION:

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs and other defects.

B. Connections: Weld or bolt shop connections, as indicated.

1. Provide field bolted connections, except where welded connections or other connections are indicated.

2. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

C. High-Strength Bolted Connection: Install high-strength threaded fasteners in accordance with AISC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts". Unless otherwise indicated, all bolted connections are to be tightened to the snug tight condition as defined by AISC.

D. Welded Construction: Comply with AWS Codes for procedures, appearance and quality of welds, and methods used in correcting welding work.

E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

F. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

G. Fabricator, Erector and General Contractor shall coordinate safety requirements for the project, in accordance with OSHA Part 1926. Provide all nessessary pieces and fabrications as required to safely erect and access the structure for the duration of project construction.

H. Camber, if any, is indicated on the drawings. Camber indicated is the required camber at time of erection. Contractor shall survey camber prior to placing metal deck.

2.03 STRUCTURAL STEEL COATINGS

A. Coordinate coating requirements with the Architect, and with Division 9 of the specifications.

B. To the greatest extent possible, structural steel coatings shall be shop applied.

C. Galvanizing, priming and painting for structural steel permanently exposed to view shall meet the requirements of Section 10 of the Code of Standard Practice, "Architecturally Exposed Structural Steel".

D. Provide venting/drainage holes in closed tubular members to be hot-dipped galvanized. Holes shall be provided in a location hidden from view in the final condition and in a manner that will not reduce the strength of the member. Hole locations shall be clearly indicated on the Shop Drawings and are subject to review by the Architect.

E. Follow manufacturer's installation and safety instructions when applying coatings. Adhere to recoat time recommendations set forth by manufacturer.

F. General: Shop priming of structural steel is not required for heated, interior steel not exposed to view unless noted otherwise.

G. Steel which is to receive spray-on fireproofing shall not to be primed or painted, unless specified by the Architect.

H. Coatings: All exterior steel and/or steel permanently exposed to view shall receive a coating. Unless noted otherwise, refer to Division 9 specifications for products and surface preparation requirements.

I. Brick masonry loose lintels and relieving angle assemblies, including fasteners, shall be hot dipped galvanized, unless noted otherwise on the Architectural Drawings

J. Unheated structural steel to be enclosed with architectural finishes, including but not by limitation, canopy members and/or roof pop-up members shall be primed with rust inhibitive alkyd primer, Tnemec Series 349 unless noted otherwise. Follow manufacturer's instructions for surface preparation and application. Substitution shall be equal to the above specified products, and shall be submitted for review.

K. Steel Embedded in Concrete/Below Grade: Steel which is embedded in concrete, below grade/slab level, or as otherwise indicated on the drawings, shall be field painted with TNEMEC FIBRETAR No 250 Coal Tar Epoxy. Paint embedded areas only. Do not paint surfaces which are to be welded until welding is complete.

L. Field Touch-up: Touch-up all paint and galvanizing damage, including but not by limitation, damage caused during shipping, erection, construction damage, and field welded steel. See Division 9 specifications for additional requirements.

PART 3 EXECUTION

3.01 ERECTION:

A. General: Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

B. Erection Procedures: Comply with "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

C. Surveys: Employ a Registered Land Surveyor elevations of concrete bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect and Structural Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been approved by Structural Engineer of Record. Additional surveys required to verify out-of-alignment work and/or corrective work shall be performed at the contractor's expense.

D. Temporary Shoring and Bracing: This is the sole responsibility of the Contractor. Provide temporary shoring and bracing members with connections of sufficient strength to support imposed loads. Remove temporary members and connections when all permanent members are in place, and all final connections are made, including the floor and roof diaphragms. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Comply with OSHA Standard referenced previous. Retain the services of a Specialty Structural Engineer (Not the Engineer of Record) to design specialty shoring and bracing.

E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

1. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

2. Welding to anchor bolts for corrective measures is strictly prohibited without prior written approval from the Engineer.

F. Setting Plates and Base Plates:

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Refer to division 3 of the project Specifications for anchor bolt installation requirements in concrete.

2. Clean concrete bearing surfaces of bond-reducing materials. Clean bottom surface of setting and bearing plates.

3. Set loose and attached base plates for structural members on wedges or other adjusting devices.

4. Pack non-shrink grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

G. Concrete slabs that are part of elevated floors framing systems shall achieve 28-day design strength prior to the application of any superimposed loads such as curtain walls, masonry veneer, mechanical equipment and stairs. Additional testing beyond that specified in division 3 required to verify the concrete strength prior to application of superimposed loads shall be done at the Contractor's expense.

H. When installing expansion bolts or adhesive anchors, the contractor shall take measures to avoid drilling or cutting any existing reinforcement or damaging adjacent concrete. Holes shall be blown clean with compressed air and/or cleaned per manufacturer's recommendations prior to the installation of anchors.

I. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated.

2. Align, adjust, level and plumb members of complete frame in to the tolerances indicated in the AISC Code of Standard Practice and in accordance with OSHA regulations.

3. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.

4. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

5. Splice members only where indicated and accepted on shop drawings.

6. 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.

7. Composite shear studs shall be installed using stud welding process with an appropriately sized insulating ferrule. Fillet welding of shear studs is not permitted. Ferrules shall be broken free from the shear studs and removed from the deck surface along with all other debris.

J. Coat columns, base plates, and brace elements encased in concrete and/or below grade with coal tar epoxy. Coordinate coating with concrete work.

K. Erection bolts: Remove erection bolts. On exposed welded construction fill holes with plug welds and grind smooth at exposed surface.

L. 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 accepted by the Engineer of Record. Finish gas-cut sections equal to a sheared appearance when permitted.

M. Coating Damage: Touch up shop applied paint or galvanizing whenever damaged or bare. See "Coatings" sections for additional requirements.

N. Field Cut Beam Web Penetrations:

1. Field cut beam web penetrations are not permitted without written approval from the Structural Engineer.

2. Gas cutting torches are not permissible for cutting beam web penetrations without written approval from the Structural Engineer.

3. Beams with field cut beam web penetrations may require reinforcement, subject to the evaluation by the Structural Engineer.

4. The evaluation of field cut web penetrations by the Structural Engineers for Design-Build Subcontractors, including but not by limititation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be compensated by the General Contractor or Design-Build Subcontractor.

5. The cost of execting field cut web penetrations and the associated beam reinforcement for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be paid for by the General Contractor or Design-Build Subcontractor.

6. Field cut beam web penetrations may not be permitted in certain locations, subject to the evaluation by the Structural Engineer.

O. Welders shall have current evidence of passing and maintaining the AWS D1.1 Qualifications test available in the field.

P. Welding electrodes, welding process, minimum preheat and interpass temperatures shall be in accordance with AISC and AWS specifications. Any structural steel damaged in welding shall be replaced.

Q. Field Welded Moment Connections:

1. Welding of Moment Connections shall meet the requirements of FEMA 353.

2. Backing materials for top and bottom flanges for field welded moment connections shall be removed, backgouge the weld root, and apply a reinforcing fillet weld.

3. Where top flange steel backing materials are utilized, the backing may be left in place. In this case, the backing material shall be welded with a reinforcing fillet weld.

3.02 QUALITY CONTROL:

A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.

1. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.

B. Testing: Owner shall engage an Independent Testing Agency to inspect all high-strength bolted and welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.

1. Testing agency shall conduct tests and state in each report which specific connections were examined or tested, whether the connections comply with requirements, and specifically state any deviations therefrom.

2. Contractor shall provide access for testing agency to places where structural steel work is being fabricated, produced or erected so that required inspection and testing can be accomplished. Testing agency may inspect structural steel at plant before shipment. The Engineer, however, reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

C. Inspection Requirements (to be performed by the Independent Testing Agency):

1. Bolted Connections: Inspect all bolted connections in accordance with procedures outlined in the AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts.

2. Snug Tight Bolted Connections:

    a. The inspector shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.

    b. If the inspector does not monitor the installation of bolts, he shall visually inspect the connection to determine that all plies of connected material have been drawn together and conduct tests on a sampling connection bolts to determine if they have been tightened to the snug tight condition. The test sample shall consist of 10% of the bolts in the connection, but not less than two bolts, selected at random. If more than 10% of the tested bolts fail the initial inspection, the engineer reserves the right to increase the number of bolts tested.

3. Slip Critical Bolted Connections:

    a. The inspector shall monitor the calibration of torquing equipment and the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.

    b. If the inspector does not monitor the calibration or installation procedures, he shall test all bolts in the affected connection using a manual torque wrench to assure that the required pretension has been reached.

4. Field Welded Connections: inspect and test during fabrication of structural steel assemblies, and during erection of structural steel all welded connections in accordance with procedures outline in AWS D1.1. Record types and location of defects found in work. Record work required and performed to correct deficiencies.

    a. Certify welders and conduct inspections and tests as required. Submit welder certifications to Engineer of Record. Perform visual inspection of all welds. Primary and secondary welds, including fillet welds, full penetration welds, and deck puddle welds, applied in the field and/or shop, shall be visually inspected.

    b. Welds deemed questionable by visual inspection shall receive non-destructive testing. In addition, all partial and full penetration welds, and any other welds indicated on the drawings are to receive non-destructive testing. Non-destructive testing methods include the following:

        1. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".

        2. Ultrasonic Inspection: ASTM E 164.

c. All welds deemed unacceptable shall be repaired and retested at the Contractor's expense.

D. Composite Shear Studs/Deformed Bar Anchors: [Delete on non-composite projects]

1. Verify shear stud quanity and arrangement.

2. Visually inspect stud weld. A weld less than 360 degrees is cause for further testing by bending to 15 degrees per item 2 below. Strike all studs with a 3 pound sledge hammer with moderates force. Studs shall make a ringing sound when struck with the hammer. If a stud or studs breaks free, or fails to make a ringing sound, further testing shall be performed per item 3.

3. One stud in 100 shall be tested by bending to 15 degrees from vertical, and one stud in 200 shall be tested by bending to 30 degrees from vertical. Single bent studs may be left bent. Failure of stud weld during bend testing is cause for further testing per item 3.

4. When failure occurs during bend testing, additional bend testing shall be performed on 10 studs to either side of failed stud. Bend studs to 30 degrees from vertical. If failure occurs during additional testing, continue testing in series of 10 studs beyond failed stud until no failure occurs.

5. Straighten all studs that were bent in multiple stud testing. Replace all studs that fail.

6. Inspector shall verify that all ferrules are removed and that composite metal deck is free of debris prior to concrete placement.

E. Testing and inspection reports shall be submitted to the Owner, Architect and Engineer within 48 hours of completion of each test or inspection.

F. Nonconforming Work: Contractor shall be responsible for correcting deficiencies in structural steel work which inspections laboratory test reports have indicated to be not in compliance with requirements. Additional tests and/or surveys shall be performed, at the Contractor's expense, as may be necessary to show compliance of corrected work. Any costs associated with the Engineer's review and disposition of faulty works shall be borne by the Contractor.

END OF SECTION

SECTION 053000 – METAL DECKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK

A. Extent of metal floor and roof deck is shown on the drawings and includes type VL composite floor deck, roof deck, cell closures, end plates, pour stops with vertical leg return lip, metal lath column closures, composite finish strips, welding washers and sump plates or pans.

1.03 RELATED WORK

1. Section 05120 - Structural Steel

2. Section 05500 - Metal Fabrications

1.04 QUALITY STANDARDS

A. Codes and Standards: Comply with provisions of the following codes and standards, except where more stringent requirements are indicated or specified:

1. AISI "Specification for the Design of Cold Formed Steel Structural Members".

2. AWS D1.1 "Structural Welding Code" - Steel

3. AWS D1.3 "Structural Welding Code" - Sheet Steel

4. Steel Deck Institute (SDI) " Design Manual for Floor Decks and Roof Decks".

5. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Qualification of field welding: Qualify welding process and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."

1.05 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

H. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings.

a. Submit detailed drawings showing layout and types of deck panels, galvanizing, shop paint, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing, and all other accessories. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. Submit one print and one reproducible. Print will be reviewed and a reproducible will be returned to Contractor for printing and distribution. Multiple copies will not be marked by Engineer.

b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. Incomplete submittals will not be reviewed.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Store materials to permit easy access for inspection and identification. Keep deck sheets off ground, using pallets, platforms, or other supports. Protect deck sheets and packaged materials from corrosion and deterioration.

C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.01 GENERAL:

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. United Steel Deck

2. Wheeling Corrugating Co.

3. Epic Metals Corporation

4. Vulcraft

B. Materials:

1. Steel for Metal Deck Units:

a. Floor Deck Units: ASTM A611, Grade C, D or ASTM 653-94, Structural Quality, grade 40 or higher

b. Roof Deck Units: ASTM A611, Grade C, D, or E, or ASTM 653-94, Structural Quality, grade 33 or higher.

2. Miscellaneous Steel Shapes: ASTM A36 minimum.

3. Sheet metal Accessories: ASTM A526, commercial quality, galvanized.

C. Galvanizing: Conform to ASTM 924-94 with minimum coating class of G60 (Z180) as defined in ASTM A653-94.

D. Paint: Manufacturer's baked on, rust inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.

E. Flexible closure Strips: Manufacturer standard vulcanized, closed-cell, synthetic rubber.

2.02 FABRICATION:

A. General: Form deck units in lengths to span 3 or more supports, unless otherwise noted on the drawings, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated. For roof deck units, provide deck configurations complying with SDI "Roof Deck Specifications," of metal thickness, depth and width as shown.

B. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.

C. Metal Closure Strips: Fabricate metal closure strips, cell closures, "Z" closures, column closures, pour stops, girder fillers and openings between decking and other construction, of not less than 0.045" min. (18 gage) sheet steel or as indicated on the drawings. Form to provide tight fitting closures at open ends of cells or flutes and sides of decking.

D. Pour Stops: Minimum material thickness shall be 18 gage or as indicate on drawings.. Fabricate vertical leg to accommodate specified slab thickness. Fabricate horizontal leg to minimize field cuts. Provide welded attachment sufficient to resist forces during concrete placement.

E. Roof Sump Pans: Fabricate from a single piece of 0.071" min. (14 gage) galvanized sheet steel with level bottoms and sloping sides to direct water flow to the drains, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1 1/2" below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

F. Provide all pour stops and accessories necessary to contain concrete for poured concrete surfaces.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before permanently fastened. Deck shall be in full contact with members parallel to ribs and attached as indicated. Do not stretch or contact side lap interlocks.

C. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.

D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

E. Coordinate and cooperate with the structural steel erector in locating decking bundles to prevent overloading of structural members.

F. Do not use decking units for storage or working platforms until permanently installed.

3.02 FASTENING:

A. Floor Deck: Fasten metal deck to supporting steel members as indicated on the Design Drawings: Each deck is to be fastened with a minimum of 5/8" diameter puddle welds spaced not more than 12" o.c. with a minimum of 2 welds per unit at each support. Secure deck units at 6" oc along brace lines, edge of building or at the edge of openings or deck discontinuity. Secure deck to each supporting member in ribs where sidelaps occur. Use welding washers where recommended by the deck manufacturer. Deck units shall bear over the ends of supports by a minimum of 1.5. Sidelaps: #10 Tek screws, 5/8" arc puddle welds or 1" long fillet welds, intervals not exceeding 36 inches. Crimped or button punched sidelaps are not permitted.

B. Roof Deck: Each deck is to be fastened with a minimum of 5/8" diameter puddle welds spaced in a 24/4 pattern (3N deck) with a minimum of 2 welds per unit at each support if incomplete sheet is utilized. Where support is parallel to support, at edge of building, at brace lines, at edge of opening or deck discontinuity provide puddle welds at 6" o.c. Secure deck to each supporting member in ribs where sidelaps occur. Deck units shall bear over the ends of supports by a minimum of 1.5". Sidelaps: #10 Tek screws, 6 per span for N deck.

C. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

D. Uplift loading: Floor deck units are not required to resist uplift loads. Decking units used at the roof level shall be designed for a net uplift of 18 psf.

E. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.

F. Reinforcement at openings: Provide additional metal reinforcement and closures pieces as required for strength, continuity of decking and support of other work shown.

1. Deck penetrations affecting no more than (1) deck rib need not be reinforced.

2. For deck penetration affecting more than (1) deck rib, but less than 10", reinforce the opening with a 0.057" thick plate spanning between unaffected ribs, unless otherwise shown on the Design Drawings or supporting a piece of mechanical equipment (see item 3).

3. Reinforce deck penetrations larger than 10" with the structural frame described in the Design Drawings.

G. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.

H. Roof Sump Pans: Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12" on center with at least 1 weld in each corner. Cut opening in roof sump bottom to accommodate drain size indicated.

I. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.

J. Touch-Up Painting:

1. Painted Deck: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

a. Touch up painted surfaces with same type paint used on adjacent surfaces.

b. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.03 QUALITY CONTROL:

A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.

B. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.

C. Testing: Owner shall engage an Independent Testing Agency to inspect all puddle welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.

D. Deck Testing Requirements (to be performed by the Independent Testing Agency):

1. Deck and accessory welding and/or attachments subject to inspection and testing. Work found to be defective will be removed and replaced at the Contractor's expense.

2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If re-certification of welders is required, re-testing will be the Contractor's responsibility.

END OF SECTION

SECTION 054000 – EXTERIOR COLD FORMED METAL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF THE WORK

A. Work specified within this Section includes, but is not necessarily limited to, the following:

1. Provide and install steel stud structural framing system at exterior walls as noted on the Drawings.

2. Providing and installing miscellaneous fasteners, hat channels, stiffeners, bridging, expansion joints, and accessories necessary to complete the work.

B. Related work specified elsewhere:

1. Interior Partition Walls: Section 09250 - Gypsum Wallboard Systems

2. Exterior Gypsum Sheathing: Section 09265 - Gypsum Sheathing

1.03 QUALITY ASSURANCE

A. Materials and installation shall conform to recommendations of the following publications:

1. American Iron and Steel Institute Cold-Formed Steel Design Manual, *"Specification for the Design of Cold-Formed Steel Structural Members"*.

2. AWS D1.1 "Structural Welding Code" - Steel.

3. AWS D1.3 "Structural Welding Code" - Sheet Steel.

4. ASTM C 954, Standard specification for steel drill screws for the application of gypsum board or metal plaster bases to steel studs from 0.033 in. to 0.112 in. thickness.

5. ASTM C 955, Standard Specification for Load-Bearing Steel Studs, Runners, and Bracing or Bridging, for Screw Application of Gypsum Board and Metal Plaster Bases.

6. ASTM C 1007 Standard Specification for installation of load bearing steel studs and related accessories.

7. Standard Specification for installation of load bearing steel studs and related accessories.

8. ASCE 7-05 "Minimum Design Loads for Building and Other Structures."

9. 2006 International Building Code

10. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Maximum Allowable Deflections: Deflection limitations, (either horizontal or vertical), include the effect of studs only, not sheathing or facing material. Spans are measured in inches between the attachments to structural steel or concrete.

1. Supporting Masonry or Brick Veneer: 1/600 of span or 0.3 inches

2. Supporting Siding: 1/360 of span

C. Design wind pressures: Design wind pressures calculated in accordance with ASCE 7-05 for Components and Cladding, shall be used in the design of the exterior cold formed steel framing system. Utilize wind speed, importance factor and exposure indicated on the project General Notes.

D. Slip Track Tolerances: Where non-bearing light gage framing abuts the structure, provide a slip joint capable of accommodating the vertical movement of the structure. Slip joint gaps shall allow for 3/4" Live Load deflection of the supporting member. Minimum depth of slip track shall be 2". Minimum thickness shall be 14 gage. Slide clips are also acceptable where applicable.

1.04 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Product Data: Submit Manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications.

1. Steel Studs

2. Anchors and anchor bolts

3. Self drilling screws

H. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.

2. General: Submit shop drawings showing the following:

a. Stud gages and spacings.

b. Sizes, gages and fastenings for all built-up members including but not limited to headers and jambs.

c. Shop Coatings

d. Type, size, quantity, locations and spacings of all anchorages and self drilling screws.

e. Details of attachment to structure and adjacent work

f. Supplemental strapping, bracing, splices, bridging, hat channels and other accessories required for proper installation.

g. Critical installation procedures.

3. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. **Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**

4. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. **Incomplete submittals will not be reviewed.**

I. Design calculations shall be prepared by a Professional Engineer (Specialty Engineer) registered in the State of Maine, illustrating the design of exterior steel stud wall systems including all all necessary stiffeners and bracing connections and anchorage required for a complete structural system.

J. The Specialty Engineer shall design the attachments of veneer and siding elements, such that pull out loads under wind or seismic loads will not be exceeded. Coordinate this design with other specification sections, including Unit Masonry and Precast Concrete.

K. Professional Engineer responsible for design of cold formed framing shall review the installation and submit a cooresondence indicating compliance with the design. Review shall include all work Any descrepencies noted shall be corrected and reviewed by the Engineer prior to the submittal of the coorespondence.

L. LEED Documentation: Refer to paragraph 1.06 of this section and Section 01352.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.

C. Store materials to permit easy access for inspection and identification. Keep cold formed members off ground, using pallets, platforms, or other supports. Protect cold formed members and packaged materials from corrosion and deterioration.

D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

1.06 LEED Requirements:

A. Material Recycled Content: Cold formed metal framing material shall meet the following minimum recycled content:

1. Post-consumer recycled content: 50%

2. The sum of the post industrial and post consumer recycled content: 60%

3. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.

B. Local/Regional Materials: Cold formed metal framing fabrication shall be located within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of the building site.

C. Waste Management: Collect metal deck offcuts and scrap and place in designated areas for recycling.

PART 2 PRODUCTS

2.01 FRAMING MEMBERS

A. Steel Studs:

1. Acceptable manufacturers: Manufacturer shall be a member of the Steel Stud Manufacturers Association.

2. Minimum stud shall be 6", 18 gage with 1.625" flange at siding.

3. Minimum stud shall be 6", 16 gage with 2.0" flange at masonry veneer.

4. Maximum Spacing: 16 inches, on-center.

5. Minimum studs indicated have not been engineered, but are provided as a general guideline. Engineering of studs is the responsibility of the Specialty Design Engineer referenced in the Submittals Section, and not the Engineer of Record nor the Architect of Record. Any exterior stud size, gage, spacing, bracing and connection information shown on the Contract Documents is schematic only. The Contractor shall provide the studs and built-up sections, engineered by the Specialty Engineer. If studs of a thicker gage or lesser spacing are required by the Specialty Engineer's design, the studs shall be provided at no additional cost to the Owner.

6. Provide channel-shaped load-bearing studs, channel-shaped joists, runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, stiffeners, fasteners, and other accessories recommended by manufacturer for complete framing system

7. Steel framing materials shall comply with ASTM A 446, A 570, or A 611, as applicable. Fabricate all components from structural quality sheet steel with the following minimum yield points:

    a. 16 ga. and heavier 50,000 psi

    b. 18 ga., 33,000 psi

    c. 20 ga., 33,000 psi (permitted for bottom track only).

8. Manufacture of studs, runners (track), and other framing members shall comply with ASTM C 955.

9. Framing components shall be galvanized per ASTM A 525, minimum G-60 coating.

B. Screws and other attachment devices:

1. Provide a protective cadmium or zinc plated coating and comply with ASTM A 165 type NS.

2. Self-drilling screws shall comply with the Industrial Fastener Institute Standard for steel self-drilling and tapping screws (IFI-113).

3. Penetration through jointed materials shall not be less than three (3) exposed threads.

C. Standard Steel Shapes: Standard steel shapes, plates, etc. shall conform to material and finish specifications in Division 5 -Miscellaneous Metals.

PART 3 EXECUTION

3.01 INSTALLATION

A. Product Storage: Store studs, joists, track etc. on a flat plane. Material damaged (i.e. rusted, dented, bent or twisted) shall be discarded. Protect adhesives and sealants from freezing.

B. Construction Methods: Construction may be either piece-by-piece (stick-built), or by fabrication into panels either on or off site.

C. Material Fit up: All framing components shall be cut squarely or at an angle to fit squarely against abutting members. Members shall be held firmly in position until properly fastened. Prefabricated panels, if used, shall be square and braced against racking. Provide blocking and strapping within 12" of slip joint and at 8'-0" o.c., or as required for member bracing.

D. Attachment: Components shall be joined by self-drilling screws, so that connection meets or exceeds required design loads. Wire tying of framing components will not be permitted. Field welding will be permitted only where shown on the drawings.

E. Anchorage to Structure: Securely anchor studs and track to floor construction and overhead structure. Provide fasteners at a maximum of 16" on center. Provide slip joints where non-bearing vertical studs meet floor or roof structural steel, or as indicated on the drawings. Provide sill sealer beneath all floor tracks.

F. Welding: Shop and field welds shall conform to applicable AWS and AISI standards, and may be fillet, plug, butt or seam type. Touch-up damage to galvanizing caused by welding with zinc-rich paint.

G. Openings: Frame openings larger than 2 ft. square with double studs. Provide suitable reinforcements (double studs, headers, jack studs, cripples, bracing, etc.) at control joint intersections, corners, and other special conditions.

H. Lintels: Lintels supporting masonry veneer shall be secured to studs by screws or power-driven anchors. Method of anchorage shall be sufficient to support veneer with a factor of safety of 3.0.

I. Bridging/Bracing: Provide horizontal strap bracing for all walls. Minimum requirements are as follows: Horizontal bracing shall be continuous 20 gage x 1 1/2" wide steel straps on each face of the stud, located at 4'-0" maximum for the full height of the wall. Provide CR runner solid bridging at 8'-0" for the full height of the wall at each line of bracing. An additional row of bracing shall be provide within 12 inches of the slip joint.

J. Tolerances: Finished installation shall be level and plumb within a tolerance of 1/8 inch in 10 feet horizontally and vertically. Maximum deviation from plan or section dimension shall not exceed 1/8 inch. Spacing of studs shall not be more than 1/8 inch from design spacing, providing that cumulative error does not exceed requirements of finishing materials.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR Credit 2.1 – Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
LEED MR Credit 2.2 – Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (referenced above) for a total of at least 75% of non-hazardous construction and demolition debris.
LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.

1.2 SUMMARY

A. This Section includes the following:

1. Steel framing and supports for overhead doors.
2. Steel framing and supports for countertops.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Support angles for elevator door sills.
6. Shelf angles.
7. Loose bearing and leveling plates.
8. Steel weld plates and angles for casting into concrete not specified in other Sections.
9. Miscellaneous steel trim including steel angle corner guards.
10. Metal ladders.
11. Metal bollards.
12. Miscellaneous metal as required.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.

2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
3. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
4. Division 05 Section "Structural Steel Framing."
5. Division 05 Section "Metal Stairs."
6. Division 05 Section "Metal Gratings."
7. Division 06 Section "Rough Carpentry" for metal framing anchors.
8. Division 14 Section "Hydraulic Elevators.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Prefabricated building columns.
3. Metal nosings and treads.
4. Paint products.
5. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. LEED-Required Submittals per Division 1 Section 018113.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. 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.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

F. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.4 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).

F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

H. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group **[1 (A1)] [2 (A4)]**.

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material for Anchors in Exterior Locations: Alloy Group [1 (A1)] [2 (A4)] stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Available Products:

a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
b. Carboline Company; Carbozinc 621.
c. ICI Devoe Coatings; Catha-Coat 313.
d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain

structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm), unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.10 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

C. Prime plates with zinc-rich primer.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.13 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

2.14 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.
3. Space siderails 16 inches (406 mm) apart, unless otherwise indicated.
4. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:

1. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm steel flat bars, with eased edges.
2. Rungs: 3/4-inch- (19-mm-) diameter steel bars.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
5. Galvanize interior ladders, where indicated, including brackets and fasteners.

2.15 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate.
2. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.

B. Fabricate bollards with 3/8-inch- (9.5-mm-) thick steel baseplates for bolting to concrete slab. Drill baseplates at all 4 corners for 3/4-inch (19-mm) anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.

2.16 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.17 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.18 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No. 4.

D. Dull Satin Finish: No. 6.

E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.19 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for

use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

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

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction with through bolts. Provide four 3/4-inch (19-mm) bolts at each bollard, unless otherwise indicated.

1. Embed anchor bolts at least 4 inches (100 mm) in concrete.

B. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Preassembled steel stairs with concrete-filled treads.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Division 05 Section "Metal Fabrications" for metal treads and nosings not installed in metal stairs.
3. Division 05 Section "Pipe and Tube Railings" for pipe and tube railings.
4. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.
5. Division 09 Section "Gypsum Board" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4 inch (6.4 mm), whichever is less.

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Prefilled metal-pan stair treads.
2. Paint products.
3. Grout.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. 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.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 (cold formed).

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

E. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.

F. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

2.4 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36.

D. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

F. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

G. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

H. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Available Products:
   a. ICI Devoe Coatings; Catha-Coat 313.
   b. Moore, Benjamin, & Co.; Epoxy Zinc-Rich Primer CM18/19.
   c. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts,[**railings,**] clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously, unless otherwise indicated.
5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STEEL-FRAMED STAIRS

A. Available Manufacturers:

1. Alfab, Inc.
2. American Stair, Inc.
3. Sharon Companies Ltd. (The).

B. Stair Framing:

1. Fabricate stringers of steel channels.

a. Provide closures for exposed ends of channel stringers.

2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld or bolt stringers to headers; weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch (1.7 mm).

1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
2. Steel Sheet: Galvanized steel sheet, in damp areas.
3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
5. Shape metal pans to include nosing integral with riser.
6. At Contractor's option, provide stair assemblies with metal-pan subtreads filled with reinforced concrete during fabrication.
7. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

    a. Smooth Soffit Construction: Construct subplatforms with smooth soffits.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

E. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

H. Install precast concrete treads with adhesive supplied by manufacturer.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Steel pipe railings.

B. Related Sections include the following:

   1. Division 05 Section "Metal Stairs" for steel tube railings associated with metal stairs.
   2. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.
   3. Division 09 Section "Gypsum Board" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

   1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
   2. Stainless Steel: 60 percent of minimum yield strength.
   3. Steel: 72 percent of minimum yield strength.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

   1. Handrails:

      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

   2. Top Rails of Guards:

      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied horizontally and concurrently with 100 lbf/ ft. (1.46 kN/m) applied vertically downward.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

   3. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Uniform load of 25 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
c. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

a. Show method of finishing and connecting members at intersections.

E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

F. Welding certificates.

G. Qualification Data: For testing agency.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Pipe and Tube Railings:

a. Pisor Industries, Inc.
b. Sharpe Products.
c. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Castings: Either gray or malleable iron, unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

2.4 FASTENERS

A. General: Provide the following:
1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
2. Provide square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide cast-in-place anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. 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.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form changes in direction as follows:
1. By bending.

K. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:

1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. 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, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. At interior locations cover anchorage joint with flange of same metal as post, attached to post with set screws.

C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch (3-mm) buildup, sloped away from post.

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
   2. Use type of bracket with predrilled hole for exposed bolt anchorage.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For steel-framed gypsum board partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.7 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 055300 - METAL GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR Credit 2.1 – Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
LEED MR Credit 2.2 – Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (referenced above) for a total of at least 75% of non-hazardous construction and demolition debris.
LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.
LEED IEQ Credit 4.2 – Paints and coatings used on the interior of the building and applied on-site must comply with the following VOC criteria:

1. Architectural paints, coatings and primers applied to interior walls and ceiling are not to exceed VOC limits in Green Seal Standard GS-11 (5/20/1993); Flats 50 g/L, Non-Flats 150 g/L.
2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates are not to exceed VOC content of 250 g/L per Green Seal Standard GC-03 (1/7/1997).
3. Clear wood finishes, floor coatings, stains, sealers and shellacs applied to interior are not to exceed VOC limits per South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings (1/1/2004); Clear wood finishes – Varnish 350 g/L, Lacquer 550 g/L; Floor coatings 100 g/L; Sealers – Waterproofing sealers 250 g/L, Sanding sealers 275 g/L, All other sealers 200 g/L; Shellacs – Clear 730 g/L, Pigmented 550 g/L; Stains 250 g/L.

1.2 SUMMARY

A. This Section includes the following:

1. Metal bar gratings.

2. Metal frames and supports for gratings.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 05 Section "Structural Steel Framing" for structural-steel framing system components.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Floors: Uniform load of 75 lbf/sq. ft. (3.59 kN/sq. m) or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.
2. Limit deflection to L/240 or 1/4 inch (6.4 mm), whichever is less.

B. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to IBC 2003.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Formed-metal plank gratings.
2. Extruded-aluminum plank gratings.
3. Glass-fiber-reinforced plastic gratings.
4. Clips and anchorage devices for gratings.
5. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. LEED-Required Submittals per Division 1 Section 018113.

1.5 QUALITY ASSURANCE

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating gratings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Metal Bar Gratings:

a. Alabama Metal Industries Corporation.
b. All American Grating, Inc.
c. Barnett/Bates Corp.
d. Borden Metal Products (Canada) Limited.
e. Fisher & Ludlow.
f. Grupo Metelmex, S.A. de C.V.
g. IKG Industries; a Harsco Company.
h. Marwas Steel Co.; Laurel Steel Products Division.
i. Ohio Gratings, Inc.
j. Seidelhuber Metal Products, Inc.
k. Tru-Weld.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Rod for Grating Crossbars: ASTM A 510 (ASTM A 510M).

C. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205).

D. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.

E. Expanded Metal, Carbon Steel: ASTM F 1267, Class 1.

F. Expanded Metal, Galvanized Steel: ASTM F 1267, Class 2, Grade A.

G. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type **[304] [316]**.

H. Stainless-Steel Bars and Shapes: ASTM A 276, Type **[304] [316]**.

I. Expanded Metal, Stainless Steel: ASTM F 1267, Class 3, made from stainless-steel sheet complying with ASTM A 666, Type **[304] [316]**.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).

C. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

D. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

E. Anchors: Provide cast-in-place anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Material for Anchors in Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.

B. Zinc-Rich Primer: Zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
b. Carboline Company; Carbozinc 621.
c. ICI Devoe Coatings; Catha-Coat 313.
d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toeplates for attaching in the field.
2. Toeplate Height: 4 inches (100 mm), unless otherwise indicated.

2.6 METAL BAR GRATINGS

A. Welded Steel Grating [**WSBG-<#>**]:

1. Bearing Bar Spacing: 1-3/8 inches (35 mm) o.c.
2. Bearing Bar Depth: As required to comply with structural performance requirements.
3. Bearing Bar Thickness: As required to comply with structural performance requirements.
4. Crossbar Spacing: 4 inches (102 mm) o.c.
5. Traffic Surface: Plain.
6. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface.

B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

1. Provide not less than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
2. Furnish threaded bolts with nuts and washers for securing grating to supports.
3. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.

    a. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Grate-Fast" by Lindapter North America, Inc.

C. Do not notch bearing bars at supports to maintain elevation.

D.

2.7 FORMED-METAL PLANK GRATINGS

A. C-shaped channels rolled from heavy sheet metal of thickness indicated, and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

2.8 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

B. Galvanize steel frames and supports in the following locations:

1. Exterior.

2.9 STEEL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish gratings, frames, and supports after assembly.

C. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123/A 123M.

D. Apply shop primer to uncoated surfaces of gratings, frames, and supports, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055300

SECTION 061000

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOUCMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wood blocking and nailers.
4. Sheathing applied to wood roof trusses.
5. Z-furring supporting plywood wall sheathing.
6. Plywood backing panels.
7. Building paper.
8. Blocking for construction, accessories and Owner furnished items.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 5 Section "Cold-Formed Metal Framing" for weather-resistant gypsum sheathing applied to cold-formed framing.
3. Division 6 Section "Metal-Plate-Connected Wood Trusses."
4. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.
5. Division 6 Section "Architectural Woodwork" for interior woodwork specially fabricated for this Project.
6. Division 7 Section "Metal Wall Panels" for z-furring and rigid insulation installed behind metal siding without plywood substrate.

C. Products installed, but not furnished, under this Section include the following:
1. Division 7 Section "Building Insulation" for rigid insulation installed with z-furring and exterior plywood sheathing.

1.03 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority.
3. WCLIB - West Coast Lumber Inspection Bureau.
4. WWPA - Western Wood Products Association.
5. FSC - Forest Stewardship Council

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
   1. Preservative-treated wood and plywood.
   2. Fire-retardant-treated plywood.
   3. Engineered wood products.
   4. Power-driven fasteners.
   5. Powder-actuated fasteners.
   6. Expansion anchors.

D. LEED Submittals:
   1. Credit EQ 4.1: Manufacturers' product data for construction adhesive, including printed statement of VOC content and material safety data sheets (MSDS).
   2. Credit EQ 4.4: Composite wood manufacturers' product data for each composite wood product used indicating that bonding agent used contains no urea formaldehyde.
   3. Credit MR 7: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by and FSC-accredited certification body to comply with FSC 12, "Principals and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.

1.05 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

B. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer for both treatment and fire-retardant formulation.

C. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack plywood and other panels flat. Place spacers between each bundle of lumber, plywood, and panel products to provide air circulation. Provide for air circulation around stacks and under coverings.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 WOOD AND PANEL PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.
   4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Wood Structural Panels:
   1. Plywood: DOC PS 1.
   2. Oriented Strand Board: DOC PS 2.
   3. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
   4. Factory mark panels according to indicated standard.

D. All wood products, project-wide: Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principle and Criteria for wood building components. These components include, but are not limited to, temporary fencing, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.

2.03 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
   1. Preservative Chemicals: Copper Azole, CBA-A or CA-B, Wolmanized Natural Select.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
1. Wood sills, blocking, furring, and similar concealed members in contact with masonry or concrete.
2. Wood framing members less than 18 inches above grade.
3. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.

2.04 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5516, for plywood.
2. Use treatment that does not promote corrosion of metal fasteners.
3. Use Interior Type A High Temperature (HT), unless otherwise indicated.

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.

C. Application: Treat items indicated on Drawings, and plywood backing panels.

2.05 DIMENSION LUMBER FRAMING

A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Maximum Moisture Content: 19 percent .

C. Joists, Rafters, and Other Framing: No. 2 or better grade and the following species:
1. Spruce-pine-fir; NLGA.

2.06 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:
1. Blocking.
2. Nailers.
3. Strapping.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2grade lumber with 19 percent maximum moisture content and any of the following species:
1. Spruce-pine-fir; NLGA.
2. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:

1. Spruce-pine-fir (south) or Spruce-pine-fir, Standard or 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.07 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber, LVL: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
1. Veneer Characteristics: Douglas fir or southern pine veneers of varying thickness by widths and lengths standard with manufacturer, end-jointed with a lap-joint, butt joint, or scarf joint. Architectural Grade exposed face.
2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal- depth members.
3. Modulus of Elasticity, Edgewise: 2,000,000 psi .
4. Tension Parallel to Grain: 1850 psi.
5. Compression Parallel to Grain: 2800 psi.
6. Compression Perpendicular to Grain: 400 psi and 500 psi perpendicular and parallel to glue line.
7. Horizontal Shear: 285 psi and 190 psi perpendicular and parallel to glue line.
8. Size: 1-3/4 inches thick by depth and length indicated.
9. Products:
   a. Micro-Lam L.V.V. Headers and Beams; Trus Joist MacMillan.
   b. Versa-Lam L.V.V Headers and Beams; Boise Cascade Corporation.

2.08 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural Isheathing, fir species.
1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch, except as otherwise noted.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 1/2 inch.
3. Product: Allowed instead of plywood sheathing; Huber Engineered Wood, AdvanTech VIP+ Sheathing Panel; no substitution.

2.09 ROOF SHEATHING

A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing, fir species.
1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 5/8 inch, unless noted otherwise.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.
1. Span Rating: Not less than 40/20.
2. Nominal Thickness: Not less than 19/32 inch .
3. Product: Allowed instead of plywood sheathing; Huber Engineered Wood, AdvanTech VIP+ Sheathing Panel only; no substitution.

2.10 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch nominal thickness.

2.11 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, in roof area, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
   2. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
   3. Where pressure-preservative treated lumber is being fastened or fastened into, provide Type 304 stainless steel fasteners.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Plywood Sheathing to Cold-Formed Metal Framing: Hilti Kwik-Flex or Elco Dril-Flex; no substitution, 10-24 x 1-1/4" wafer head #3.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.12 METAL FRAMING ANCHORS

A. Manufacturer: Simpson Strong-Tie Co., Inc.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation.
   1. Use for interior locations where stainless steel is not indicated.

D. Stainless-Steel Sheet: ASTM A 666, Type 304.
   1. Use for exterior locations, locations in contact with pressure-preservative treated lumber, and where indicated.

E. Joist Hangers: U-shaped joist hangers with 2-inch- long seat and 1-1/4-inch- wide nailing flanges at least 85 percent of joist depth.
   1. Thickness: 0.050 inch.

F. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
   1. Strap Width: As needed for condition.
   2. Thickness: 0.050 inch.

G. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.

2.13 WEATHER-RESISTANT SHEATHING PAPER

A. Building Paper: ASTM D 226, Type II (No. 30 asphalt felt), unperforated.

2.14 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Install framing members of size and spacing indicated.

E. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

F. Do not splice structural members between supports, unless otherwise indicated.

G. Provide blocking as indicated and as required to support facing materials, fixtures, specialty items, and trim.

H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Do not use panel materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

K. Securely attach rough carpentry and panel work to substrate by anchoring and fastening as indicated, complying with the following:
1. NES NER-272 for power-driven fasteners.
2. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
3. Published requirements of metal framing anchor manufacturer.
4. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-Nails, and allied fasteners.

L. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
   1. Use hot-dip galvanized or stainless steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
   2. Use stainless steel nails where fastening or fastening into preservative-treated framing members.

M. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

N. Sheathing shall not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

O. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Install wood blocking and nailers to support construction and fixtures, including, but not limited to, equipment services, heavy trim, grab bars, toilet accessories, casework, furnishings, window treatment, handrail brackets, shelving, residential casework, building specialties, clothes rods, shower curtain rods, window sills, drywall window return shims, countertop supports, wall panels and standoff supports, postal specialties, panel board supports, tack boards and marker boards, Owner furnished items, metal flashing, siding and trim support, roof blocking, base flashing backer, and equipment supports, and miscellaneous items and construction. Provide 3/4-inch thick plywood covering a minimum of 32 inches square for toilet accessories. Provide 1-1/2 inch thick blocking minimum, for grab bars, door stops and handrail supports. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
   1. Provide concealed wood blocking behind gypsum wallboard where door stops are to be installed.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

C. Roofing Nailers: Install wood nailers of same total thickness as insulation. Anchor perimeter nailers to substrate in a manner to resist a force of 100 pounds per linear foot in any direction. Top nailer shall be fastened through the lower layers and into metal deck or concrete plank.

3.03 FLOOR JOIST FRAMING INSTALLATION

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
   1. Where supported on wood members, by using metal framing anchors.
   2. Where framed into wood supporting members, by using metal joist hangers.

B. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

C. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

D. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to 3 joists.

E. Anchor engineered framing with metal framing anchors, of size and type indicated.

F. Provide bridging of size and type indicated on Structural Drawings.

3.04 RAFTER FRAMING INSTALLATION

A. Rafters: Notch to fit exterior wall plates and use metal framing anchors.

3.05 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
1. Wall and Roof Sheathing:
   a. Nail to wood framing and trusses.
   b. Screw to cold-formed metal framing.
   c. Space panels 1/8 inch apart at edges and ends.
2. Plywood Backing Panels: Screw to supports.

3.06 Z-FURRING, RIGID INSULATION, AND SHEATHING INSTALLATION

A. Install rigid insulation furnished under Division 7 "Building Insulation" horizontally and hold in place with Z-furring members spaced 24 inches o.c., unless indicated otherwise.

B. Fasten Z-furring members securely through gypsum sheathing into cold-formed steel framing. Screw fasteners spaced no greater than 12 inches on center.

C. Except at exterior corners, securely attach narrow flanges of furring members to wall with fasteners spaced not more than 12 inches o.c.

D. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

E. Protect rigid insulation from exposure to sunlight by installing wall sheathing to z-furring immediately. Fasten in accordance with requirements "Wood Structural Panel Installation" article above.

3.07 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover wall sheathing with weather-resistant sheathing paper as follows:
1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails.

END OF SECTION 06100

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Shelving.
3. Interior railings.

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
2. Division 06 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
3. Division 06 Section "Interior Architectural Woodwork" for interior woodwork not specified in this Section.
4. Division 09 Section "Interior Painting" for priming and backpriming of interior finish carpentry.

1.3 DEFINITIONS

A. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.
7. FSC: Forest Stewardship Council

B. MDF: Medium-density fiberboard.

C. MDO Plywood: Plywood with a medium-density overlay on the face.

1.4 SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical treatment manufacturer's written instructions for finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Samples for Initial Selection: For each type of paneling indicated.

C. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels.
3. For interior wood columns, include[**quarter-section**] Samples of cap, base, plinth, and 6-inch- (150-mm-) long[**quarter-section**] Sample of shaft.[**Samples need not be same diameter as required columns.**]

D. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for adhesives and glues, including printed statement of VOC content.
2. Credit EQ 4.4: Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent contains no urea formaldehyde.
3. Credit MR7: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by and FSC-accredited certification body to comply with FSC 12, "Principles and Criteria." Include evidence that mill is certified for chain-fo-custody by an FSC-accredited certification body.

E. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.

F. Warranty: Special warranty specified in this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

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

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

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

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: AHA A135.4.

D. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

E. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.

F. All wood products, project-wide: Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC)

Principle and Criteria for wood building components. These components include, but are not limited to, temporary fencing, structural framing and general dimensional framing, flooring, sub0flooring, wood doors and finishes.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Lumber: AWPA C2. Kiln dry after treatment to a maximum moisture content of 19 percent.

B. Plywood: AWPA C9. Kiln dry after treatment to a maximum moisture content of 18 percent.

C. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

D. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.

E. Do not use material that is warped or does not comply with requirements for untreated material.

F. Mark lumber with treatment quality mark of an inspection agency approved by ALSC's Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

G. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

1. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

H. Application: Where indicated.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Lumber: Comply with performance requirements in AWPA C20, Exterior type. Kiln dry after treatment to a maximum moisture content of 19 percent.

B. Plywood: Comply with performance requirements in AWPA C27, Exterior type. Kiln dry after treatment to a maximum moisture content of 15 percent.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants and provide materials that do not have marks from spacer sticks on the exposed face.

D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

F. Application: Where indicated or required by code.

2.4 STANDING AND RUNNING TRIM

A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: Birch; NHLA.
2. Maximum Moisture Content: 13 percent.
3. Species for dark wood: Smith and Fong Dura Palm PB EG3472UPN
4. Finger Jointing: Not allowed.
5. Gluing for Width: Not allowed.
6. Veneered Material: Allowed at window sills and other place with written permission by architect.
7. Face Surface: Surfaced (smooth).

B. Lumber Trim for Opaque Finish (Painted):
1. Species and Grade: White woods, D Select; WWPA.
2. Maximum Moisture Content: 19 percent.
3. Finger Jointing: Allowed.
4. Face Surface: Surfaced (smooth).

2.5 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1, made without urea-formaldehyde adhesive.

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. Chesapeake Hardwood Products, Inc.
   b. Davidson Plywood; a division of Do+Able Products, Inc.
   c. Georgia-Pacific Corp.

2. Face Veneer Species and Cut: Plain-sliced Birch.
3. Veneer Matching: Selected for similar color and grain.
4. Backing Veneer Species: MDF.
5. Thickness: 1/2 inch unless noted otherwise.
6. Glue Bond: Type II (interior).

B. Bamboo Paneling:

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. Smith and Fong: Tambour paneling.

2. Thickness: 3/16" inch.

C. Fiberglass Reinforced Panels (FRP)

1. Provide fiber glass-reinforce panels (FRP) around janitor sinks and other wet areas.

2.6 SHELVING AND CLOTHES RODS

A. Concealed Shelving: Made from 3/4 inch (19 mm) thick.
   1. Melamine-faced particleboard with applied PVC front edge.
   2. Wood boards as specified above for lumber trim for opaque finish.
   3. Softwood Boards: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; Finish or 1 Common (Colonial); NeLMA, NLGA, or WWPA; kiln dried.

B. Shelf Brackets: BHMA A156.16, B04051; prime-painted formed steel for fixed.

C. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; steel.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

   1. Where galvanized finish is indicated, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

   1. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Paneling Adhesive: Comply with paneling manufacturer's written recommendations for adhesives.

   1. Use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

1. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 FABRICATION

A. Back out or kerf backs of the following members except those with ends exposed in finished work:

1. Interior standing and running trim except shoe and crown molds.
2. Wood board paneling.

B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
2. Install trim after gypsum board joint finishing operations are completed.
3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 PANELING INSTALLATION

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch (6-mm) gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.

1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners as recommended by panel manufacturer.
2. Conceal fasteners to greatest practical extent.
3. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.
4. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards. Install with uniform tight joints between boards.
5. Fasten paneling to gypsum wallboard with panel adhesive.

3.6 SHELVING INTALLATION

A. Cut shelf cleats at ends of shelves about 1/2 inch (13 mm) less than width of shelves and sand exposed ends smooth.

B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches (400 mm) o.c.

1. Apply a bead of multipurpose construction adhesive to back of shelf cleats right before installing. Remove adhesive that is squeezed out immediately after fastening shelf cleats in place.

C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches (900 mm) o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

D. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches (300 mm) o.c.

E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.

1. Fasten shelves to cleats with finish nails or trim screws, set flush.
2. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

3.7 ADJUSTING

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

3.8 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.9 PROTECTION

A. Protect installed products from damage from weather and other causes during remainder of the construction period.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

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

END OF SECTION 062023

SECTION 068400

LAVATORY COUNTERTOPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:
LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.02 SUMMARY

A. This Section includes synthetic marble counter tops with integral lavatory bowl.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 7 Section "Joint Sealants."
3. Division 12 Section "Residential Casework" for manufactured cabinets and postformed plastic-laminate countertops.
4. Division 15 Sections for faucets and plumbing connections.

1.03 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. Product Data: For each type of product indicated. Include manufacturer's installation instructions.

C. Shop Drawings: Indicate length and depth of units, sizes of splashes, aprons, faucet cutouts.

D. Sample: When requested by Architect, one full size lavatory top with integral bowl matching color approved.
1. Approved full-size Samples will be returned and may be used in the Work providing they are undamaged.

E. Product Certificates: Signed by manufacturer of lavatory countertop certify that product meets ANSI Z124.3 requirements.

F. LEED Submittals:

1. Credits MR 4.1 and MR 4.2: Product data indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content, including printed statement indicating costs for each product having recycled content.

2. Credit EQ 4.1: Manufacturers' product data for installation adhesive used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.04 QUALITY ASSURANCE

A. Source Limitations for Lavatory Countertops: Obtain lavatory countertops through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver lavatory countertops to site in manufacturer's sealed, undamaged shipping containers. Inspect products upon receipt to ensure products are free from damage occurring in transit.

B. Store products in covered area, above ground, and protected from inclement weather and humidity.

PART 2 - PRODUCTS

2.01 LAVATORY COUNTERTOPS

A. Lavatory Countertops : Provide units having the following characteristics:

Avonite Studio Collection:
1. Side Splashes: Shall be fabricated of same material and color as countertop.
2. Fasteners: Include screws and other fasteners used for installation. Fasteners shall not be exposed.
3. Color: As selected by Architect from manufacturer's full range of colors.
4. Manufacturers:
   a. Avonite Surfaces, 7350 Empire Place, Florence, KY 41042 USA.

B. LAVATORY SINKS

1. Seamless Sink VB-1815
2. OD: 18-1/8" x 14-3/4"
3. ID: 16-1/2" x 13-1/4" x 5-7/8" deep
4. VB-18151 Ivory F--8106 Satin

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Anchor securely by attaching to supports at underside of countertop with adhesive.

B. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

C. Set side splashes in bed of silicone sealant and secure to walls with adhesive.

D. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

END OF SECTION 108400

SECTION 07100

CEMENTITIOUS WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes cementitious waterproofing for elevator pits.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 3 Section "Cast-in-Place Concrete."
3. Division 7 Section "Self-Adhering Sheet Waterproofing" for below grade waterproofing.

1.03 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For each type of product indicated, including installation instructions.

C. Qualification Data: For Installer.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced waterproofing Applicator.

B. Source Limitations: Obtain cementitious waterproofing materials through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials and equipment in a single area of project site. Provide adequate means to protect floors and adjacent surfaces of this area from damage.

1.06 PROJECT CONDITIONS

A. Weather Limitations: Do not apply waterproofing when effects of freezing or moisture will adversely affect the waterproofing application.

B. Maintain adequate ventilation during preparation and application of cementitious waterproofing materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cementitious Waterproofing: "Five Star Waterproofing" trowel applied negative side cementitious membrane and mixing liquid system manufactured by WCM.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
   1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
   2. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   3. Application of coating to surfaces shall constitute acceptance of surfaces and conditions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surfaces must be clean. Chip or grind off all defective materials and foreign matter. Remove form treatment residue, curing compound, scum and fungus.

B. Repair cracks, breaks, honeycombing, or other surface imperfections with non-expansive patching mortar to attain a finish comparable to adjacent concrete surfaces.

3.03 INSTALLATION

A. Cementitious Waterproofing:
   1. Apply cementitious waterproofing treatment to the floor and walls of elevator pit to a minimum thickness of 1/8-inch after elevator jack hole has been poured around with cast-in-place concrete.
   2. Trowel all surfaces to a smooth, hard finish, free from pits hollows and other defects.
   3. Provide 1-inch by 1-inch cant at intersection of horizontal and vertical surfaces.
   4. Apply in strict accordance with manufacturer's instructions.

3.04 PROTECTION

A. Protect waterproofing from damage by other trades after installation to maintain the integrity of the waterproofing.

END OF SECTION 07100

SECTION 071310

WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Rubberized-asphalt sheet waterproofing.
      a. Location: All foundation walls abutting interior space, both public and non-public.
      b. Contractor Option: See Section 07141 "Cold Fluid-Applied Waterproofing" for optional waterproofing instead of self-adhering sheet waterproofing.
   2. Insulation protection board.

B. Related Sections include the following:
   1. Division 1 Section "Sustainable Design Requirements"
   2. Division 7 Section "Cold Fluid-Applied Waterproofing" for alternative waterproofing system.
   3. Division 7 Section "Building Insulation" for perimeter insulation at locations not receiving waterproofing.
   4. Division 7 Section "Self-Adhering Sheet Air/Vapor Barrier System" for tie-in with air/vapor barrier.
   5. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.
   6. Division 9 Section "Tile" for waterproof membrane installed with tile systems.

1.03 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

D. Samples: For the following products:
   1. 12-by-12-inch square of waterproofing and flashing sheet.
   2. 12-by-12-inch square of protection board (insulation).

E. Installer Certificates: Signed by manufacturers certifying that Installers comply with requirements.

F. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

G. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.
1. Obtain secondary materials from a single source for each product as approved by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.07 PROJECT CONDITIONS

A. Substrate: Proceed with work after substrate construction, openings, and penetrating work have been completed and areas are free of standing or running water, ice, and frost. Verify that concrete is dry, smooth, and free from sharp or ragged out-angles, honeycombing, rock pockets, depressions, and projections.

B. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer to meet warranty requirements. Do not apply waterproofing to a damp or wet substrate.
1. Do not apply waterproofing in snow, rain, fog, or mist.

C. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.08 WARRANTY

A. General: Special warranties specified in this Section shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by Contractor under requirements of the Contract Documents.

B. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to repair or replace waterproofing material that does not comply with requirements or that does not remain watertight due to failure in materials or workmanship during specified warranty period.
   1. Warranty Period: Five years after date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 RUBBERIZED-ASPHALT SHEET WATERPROOFING

A. Rubberized-Asphalt Sheet: 60-mil- thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side.
   1. Physical Properties: As follows, measured per standard test methods referenced:
      a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
      b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
      c. Brittleness Temperature: Pass at minus 25 deg F; ASTM D 746.
      d. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
      e. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
      f. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.
   2. Products:
      a. W. R. Grace & Co.; Bituthene System 300R .
      b. Architectural approved equal.

2.03 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Provide type of primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Sheet Flashing Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.

D. Drain Protection System: :
   1. GRACE Hydroduct 220.
   2. Or architectural approved equal

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions that will adversely affect execution, durability or quality of finish work, and which cannot be put into an acceptable condition through normal preparatory work.
   1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
   2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, scum, fungus, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections. Prepare, fill, prime, and treat joints, cracks, honeycomb, aggregate pockets, holes, and other voids in substrates with non-expansive patching mortar to attain a finish comparable to adjacent concrete surfaces. Remove dust and dirt from joints, cracks, and other irregularities according to ASTM D 4258 prior to priming and filling.

E. Bridge and cover cold joints with overlapping sheet strips.
   1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

F. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.03 RUBBERIZED-ASPHALT SHEET APPLICATION

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Coordinate installing waterproofing materials with associated work to provide complete system complying with combined recommendations by manufacturers and installers involved in Work. Schedule installation to minimize exposure of sheet waterproofing materials.

C. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

D. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
   1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.

F. Top Edge Seal: Seal top edge to provide permanent resistance to water penetration. Caulk exposed edges with mastic or sealant.

G. Seal projections through membrane and seal seams. Bond to vertical surfaces and also, where shown or recommended by manufacturer, bond to horizontal surfaces.

H. Cold Joints: Install joint filler with protruding rounded surface, as recommended by manufacturer.
   1. Apply continuous 8-inch-wide strip of membrane on joint, followed by membrane application.

I. Coat exposed areas of sheet and flashing materials. Comply with sheet manufacturer's recommendations for applying and curing the coating.

J. Install sheet waterproofing and auxiliary materials to tie into air/vapor barrier provided in Division 7 Section "Self-Adhering Sheet Air/Vapor Barrier System."

K. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.

L. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

Protection Board (Insulation): Prior to starting subsequent construction operations, install protection course with butted joints over waterproofing membrane complying with recommendations of both sheet waterproofing and protection board manufacturers.

3.04 DRAIN / PROTECTION APPLICATION:

A. Install per manufacturers' instructions.

3.05 PROTECTION AND CLEANING

A. Cleaning: After completion, remove all masking materials used in waterproofing installation. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

B. Protect waterproofing from damage and wear during remainder of construction period. Do not allow traffic of any type on unprotected membrane.

END OF SECTION 071310

SECTION 071410

COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes two-component, unmodified latex-rubber waterproofing.
   1. Location: All foundation walls abutting interior space, both public and non-public.
   2. Contractor Option: See Section 07131 "Self-Adhering Sheet Waterproofing" for alternative waterproofing system.
   3. Insulation protection board.

B. Related Sections include the following:
   1. Division 7 Section "Self-Adhering Sheet Waterproofing" for alternative waterproofing system.
   2. Division 7 Section " Self-Adhering Sheet Air/Vapor Barrier System" for tie-in with air/vapor barrier.
   3. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.
   4. Division 9 Section "Tile" for waterproof membrane installed with tile systems.

1.03 PERFORMANCE REQUIREMENTS

A. Provide waterproofing membrane that prevents the passage of water.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

D. Samples: For the following products:
   1. 12-by-12-inch square of flashing sheet.
   2. 12-by-12-inch square of protection board (insulation).

E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

F. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

G. Sample Warranty: Copy of special waterproofing manufacturer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.
1. Obtain secondary materials from a single source for each product as approved by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Protect stored materials from direct sunlight.

E. Store insulation protection board flat and off the ground. Provide cover on top and all sides.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
1. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: W. R. Grace & Co.; Procor.

2.02 WATERPROOFING MATERIALS

A. Fluid Applied Waterproofing Membrane: Fluid-applied two part, self-curing, synthetic rubber based material meeting or exceeding the performance requirements of ASTM C 836 and having the following physical properties:
   1. Cured Film Thickness: ASTM D 3767, Method A, 0.060 inch nominal.
   2. Solids Content: ASTM D 1644, 100 percent.
   3. Flexibility, 180 Deg Bend over 25 mm Mandrel at 32 deg C: ASTM D 1970, unaffected.
   4. Elongation: ASTM D 412, 500 percent minimum.
   5. Peel Adhesion to Concrete: ASTM D 903 Modified, 5 lbs./inch.
      a. Waterproofing membrane applied to concrete and allowed to cure. Peel adhesion of the membrane is measured at a rate of 2 inches per minute with a peel angle of 90 degrees at room temperature.

2.03 INSULATION PROTECTION BOARD

A. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square edged; of type, density, and compressive strength indicated below:
   1. Type IV, 1.6-lb/cu. ft. minimum density and 25-psi minimum compressive strength.
   2. Thickness: 2 inches.
   3. Products:
      a. Styrofoam; Dow Chemical Company.
      b. Foamular 250; Owens Corning.
      c. Amofoam; Tenneco Building Products.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for waterproofing application. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage or overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, loose aggregate, and other projections and fill honeycomb, aggregate pockets, and other voids.

1. Use repair materials and methods that are acceptable to the fluid-applied waterproofing manufacturer.

E. Cast-In-Place Concrete Substrates:
1. Waterproofing application may commence as soon as the substrate can accept foot traffic. Surface shall be free of any visible water.
2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
3. Repair bugholes over 13 mm in length and 6 mm deep and finish flush with surrounding surface.
4. Remove scaling to sound, unaffected concrete and repair exposed area.
5. Grind irregular construction joints to suitable flush surface.

3.03 PREPARATION AT TERMINATIONS AND PENETRATIONS

A. Prepare vertical surfaces at terminations and penetrations through waterproofing and at expansion joints, and sleeves according to ASTM C 898 and manufacturer's written instructions.

B. Apply a double thickness of waterproofing and embed a joint reinforcing strip in preparation coat when recommended by waterproofing manufacturer.

3.04 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 898 and waterproofing manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
1. Comply with ASTM C 1193 for joint-sealant installation.
2. Apply bond breaker between sealant and preparation strip.
3. Prime substrate and apply a single thickness of preparation strip extending a minimum of 3 inches along each side of joint. Apply a double thickness of waterproofing and embed a joint reinforcing strip in preparation coat.

B. Install sheet flashing and bond to wall substrates where indicated or required according to waterproofing manufacturer's written instructions.

3.05 WATERPROOFING APPLICATION

A. Apply waterproofing according to ASTM C 898 and manufacturer's written instructions.

B. Start installing waterproofing in presence of manufacturer's technical representative.

C. If area to be waterproofed is in direct sunlight and temperature is rising, apply a "scratch coat" (a thin application of fluid-applied waterproofing) over prepared substrate prior to the full application of the waterproofing membrane.

D. Mix materials and spray apply waterproofing in accordance with manufacturer's written instructions.
1. Apply minimum 1.5 mm (0.060 in.) in all areas to be waterproofed. Apply minimum 3 mm (0.120 in.) in all detail areas.
2. In applications where a minimum slope of 11 mm/m (0.13 in./ft) can not be achieved, a two coat application of membrane is required to achieve the total thickness.
3. Verify wet film thickness of waterproofing every 100 sq. ft..

3.06 INSULATION PROTECTION BOARD INSTALLATION

A. Install one layer of board insulation of required thickness over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.

B. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use type of adhesive recommended in writing by insulation manufacturer.

3.07 CURING, PROTECTING, AND CLEANING

A. Cure waterproofing according to manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.

B. Remove any masking materials after installation. Clean any stains on materials that will be exposed in the completed work using cleaning materials approved in writing by manufacturers of waterproofing and of products on which stains occur.

C. Protect waterproofing from damage and wear during remainder of construction period.

D. Protect installed board insulation from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07141

SECTION 072100

BUILDING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
Insulation under slabs-on-grade.
Foundation wall insulation (supporting backfill).
Concealed building insulation.
Foam-in-place insulation.
Vapor retarders.

B. Related Sections include the following:
Division 1 Section "Sustainable Design Requirements"
Division 3 Section "Cast-in-Place Concrete" for vapor barrier under slabs-on-grade.
Division 4 Section "Unit Masonry Assemblies" for insulation installed in cavity walls.
Division 7 Section "Self-Adhering Sheet Air/Vapor Barrier System."
Division 7 Section "EPDM-Single-Ply Membrane Roofing" for insulation specified as part of roofing construction.
Division 9 Section "Gypsum Board Assemblies" for provision in metal-framed assemblies of interior acoustical insulation and for provision of rigid insulation installed in z-furring.
Division 15 Sections for insulation on ducts, piping, and equipment.

1.03 DEFINITIONS

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For each type of product indicated.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

D. LEED Submittals:

Credit MR 4.1: Product Data indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.

a. Include statement indicating costs for each product having recycled content.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of Work.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
Surface-Burning Characteristics: ASTM E 84.
Fire-Resistance Ratings: ASTM E 119.
Combustion Characteristics: ASTM E 136.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:
Do not expose to sunlight, except to extent necessary for period of installation and concealment.
Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.07 COORDINATION

A. Sequence and coordinate installation of firesafing components specified in this and other Sections to assure completed system complies with required fire-resistance ratings and that firesafing remains dry.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

C. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.
Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Insulation under Slabs-on-Grade: Extruded-polystyrene board insulation, ASTM C 578, Type IV, 1.60 lb./cu. ft., unless otherwise indicated, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:
1. Thickness: 2 inch, unless otherwise noted.
2. Products:
   a. Styrofoam; Dow Chemical Company.
   b. Foamular 250; Owens Corning.
   c. Amofoam; Tenneco Building Products.

C. Perimeter Insulation: Extruded-polystyrene board insulation, ASTM C 578, Type IV, 1.60 lb./cu. ft., unless otherwise indicated, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:
1. Thickness: 2 inch, unless otherwise noted.
2. Edge Condition: Tongue and groove or shiplap edges for stacked insulation.
   Products:
   a. Styrofoam; Dow Chemical Company.
   b. Foamular 250; Owens Corning.
   c. Amofoam; Tenneco Building Products.

D. Rigid Insulation: Extruded-polystyrene board insulation, ASTM C 578, Type IV, 1.60 lb./cu. ft., unless otherwise indicated, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:
1. Thickness: 2-1/2 inch, unless otherwise noted.
2. Edge Condition: Square edge for installation in z-furring.
3. Products:
   a. Styrofoam; Dow Chemical Company.
   b. Foamular 250; Owens Corning.
   c. Amofoam; Tenneco Building Products.

E. Unfaced Mineral-Fiber Blanket (Batt) Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
1. Thickness: Full depth of cavity. Where cavity requires insulation that is thicker than standard size, provide next larger size and compress into cavity.
2. Manufacturers:
   a. CertainTeed Corporation.
   b. Owens Corning.
   c. Johns Manville Corporation.

F. Polyurethane Foam-In-Place Insulation (open-cell): UL classified sealant, to insulate, seal, fill, and stop air infiltration; shall not expand to the point to cause pressure on window jambs.
1. Density: 0.5 lbs./cu. ft.

2. R-Value: Not less than 4.0 per inch of thickness.
3. Fire-Test-Response Characteristics: ASTM E 84, as follows:
   a. Flame Spread: 25.
   b. Smoke Developed: 50.

G. Sound Attenuation Blankets (Acoustical Insulation): See Division 9 Section "Gypsum Board Assemblies."

2.03 VAPOR RETARDERS

A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.08 perm.
Location: attic walls and underside of trusses

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Under-slab vapor retarder specified in Division 3 Section "Cast-In-Place Concrete".

2.04 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.05 INSULATION FASTENERS

A. Insulation Support Anchor: Insul-Fast, 25 gage, galvanized continuous metal support strip with pre-punched tabs at 8 inches on center.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.04 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
Extend insulation to top of footing or full height of grade beam depending on campus.

B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board. Set in adhesive according to insulation manufacturer's written instructions.

C. Protect top surface of horizontal insulation from damage during concrete work.

3.05 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units. Fill voids in thermal envelope not covered by the work of other sections.

B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install glass-fiber blankets in cavities formed by framing members according to the following requirements:
Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
Install insulation support anchors at top of cavity and spaced every 5 feet on center full length of each cavity.

D. Ceiling Insulation: Place insulation in two-layer application consisting of a layer of 6-inch thick batt insulation between bottom chords of trusses or framing covered with 6-inch thick insulation laid perpendicular to first layer to achieve specified R-value.

3.06 INSTALLATION OF FOAM-IN-PLACE INSULATION

A. Install foam-in-place insulation sealant to a minimum depth of 1 inch, sealing roof deck flutes and construction cracks and gaps where outside air and cold can infiltrate, providing an airtight building envelope.

3.07 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
Location: Underside of roof trusses, sloped framing, and attic walls where indicated at SMCC.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
At attic walls, seal bottom of vapor retarder to concrete plank.

C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

F. Tie vapor retarder on underside of trusses and sloped framing into air/vapor barrier provided in Division 7 Section "Self-Adhering Sheet Waterproofing."

G. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.08 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 072710

AIR/VAPOR BARRIER SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes self-adhering, vapor-retarding, modified bituminous sheet air/vapor barriers on weather resistant gypsum sheathing and fluid-applied air/vapor barriers on concrete masonry units.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 5 Section "Cold Formed Metal Framing" for wall sheathings receiving air/vapor barrier.
3. Division 7 Section "Self-Adhering Sheet Waterproofing" and "Cold Fluid-Applied Waterproofing" for below grade waterproofing.
4. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

1.03 DEFINITIONS

A. Air/Vapor Barrier Assembly: The collection of air/vapor barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 PERFORMANCE REQUIREMENTS

A. General: Air/vapor barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air/vapor barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits. Barrier shall be continuous with all joints made air-tight and shall have the following characteristics:
1. Air Barrier Assembly Air Leakage: Not to exceed 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.; ASTM E 283.
2. Water Vapor Permeance: Shall not exceed 0.05 perms for 40-mil dry coating grams/ft²/hr in Hg when tested in accordance with ASTM E 96.
3. Liquid Water Absorption: Less than 0.12% (weight) when tested in accordance with ASTM D 570.
4. Shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on envelope without damage or displacement; shall transfer load to structure; and shall not displace adjacent materials under full load.
5. Shall be joined in an airtight, flexible manner to the air/vapor barrier surface/material of adjacent systems, allowing for relative movement of systems due to thermal and moisture variations or creep. Air/vapor barrier shall be connected to the following system components:
   a. Foundation and walls.
   b. Doors and windows penetrating exterior walls.
   c. Aluminum-framed entrances and storefronts.
   d. Different wall systems.
   e. Roof assemblies.
   f. Wall and roof intersections.
   g. Walls and roof assemblies over unconditioned space.
   h. Wall, floor and roof assemblies spanning control and expansion joints.
   i. Wall, floor and roof penetrations by masonry ties, screws, bolts and similar items.

j. Wall, floor and roof penetrations by pipes, ducts, and conduits.

B. Air/Vapor Barrier Penetrations: All penetrations of the air/vapor barrier and paths of air infiltration or exfiltration shall be made airtight to not less than the rating of the air/vapor barrier.

1.05 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air/vapor barrier.

C. Shop Drawings: Show locations and extent of air/vapor barrier. Include details of intersections with other envelope systems and materials; details of membrane counter-flashings; details for substrate joints and cracks, counterflashing strip, and penetrations; details for inside and outside corners; details for terminations, and tie-ins with adjoining construction. Show relationship to adjacent materials, sequence of installation and materials, and methods for sealing penetrations. Shop Drawings shall include connection details between the air/vapor barrier and for the following exterior envelope components as applicable to the Project:
1. Foundations and walls.
2. Doors and windows.
3. Aluminum-framed entrances and storefronts.
4. Wall and roof assemblies.
5. Wall penetrations by pipes, ducts and conduits.

D. Product Certificates: For air/vapor barriers, certifying compatibility of air/vapor barrier and accessory materials with Project materials that connect to or that come in contact with air/vapor barrier; signed by product manufacturer.

E. Qualification Data: For Applicator.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air/vapor barriers.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air/vapor barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and is approved in writing by air/vapor barrier membrane manufacturer.

B. Mockups: Apply air/vapor barrier membrane mockup to exterior wall assembly built in Division 5 Section "Cold Formed Metal Framing." Mockup of exterior wall assembly shall include connections between wall and foundation, wall and glazing systems, and through-wall flashings, showing relationship of materials with air/vapor barrier membrane and quality of workmanship.
1. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air/vapor barrier until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
3. Complete mockup for review at preinstallation conference.

C. Preinstallation Conference: Conduct conference at Project site.
1. Meet with air/vapor barrier membrane Installer, air/vapor barrier membrane system manufacturer's representative, and testing agency representative. Include installers of other construction connecting to air/vapor barrier, such as roofing, waterproofing, architectural precast concrete, masonry, joint sealants, windows, glazed storefronts, and door frames.
2. Review air/vapor barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and

sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

3. Review approved submittals.
4. Review mock-up.
5. Review and coordinate sequence of installation with adjacent materials.
6. Review compatibility of air/vapor barrier materials with building envelope materials.
7. Review interface of flashings and trim with air/vapor barrier system.
8. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
9. Procedures for quality assurance, testing, and corrective procedures.
10. Schedule for subsequent work covering air/vapor barrier membrane.
11. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
12. Provide 72-hour minimum advance notice to participants prior to convening preinstallation conference.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air/vapor barrier manufacturer. Packages shall be labeled with manufacturer's name, product brand name and type, date of manufacture, and shelf life.

B. Remove and replace liquid materials that cannot be applied within their stated shelf life.

C. Store rolls according to manufacturer's written instructions.

D. Protect stored materials from direct sunlight.

1.08 PROJECT CONDITIONS

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

1.09 WARRANTY

A. General: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's System Warranty: Written system warranty, signed by air/vapor barrier membrane manufacturer agreeing to replace air/vapor barrier system materials and accessories which fail to achieve specified air tightness and vapor seal, exhibit loss of adhesion or cohesion, or do not cure within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 Spray AIR/VAPOR BARRIER

A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coatings & Waterproofing; CCW-705.
   b. Grace, W. R. & Co.; Perm-A-Barrier.
   c. Henry Company; Blueskin SA.

2. Physical and Performance Properties:
   a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
   b. Tensile Strength: 500 psi minimum; ASTM D 412, Die C, modified.
   c. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
   d. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
   e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
   f. Water Absorption: 0.12 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
   g. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.02 FLUID-APPLIED AIR/VAPOR BARRIER MEMBRANE FOR CONCRETE MASONRY UNITS

A. Fluid-Applied Air/Vapor Barrier Membrane: Provide one the of the following:
   1. Perm-A-Barrier Liquid Air/Vapor Barrier Fluid-Applied Membrane, two-part, self-curing, rubber-based fluid for spray application; Grace Construction Products.
   2. BARRISEAL-S spray grade water-based asphalt emulsion modified with a blend of synthetic rubbers and special additives, compatible with sheet membranes, complying with specified thickness; Carlisle Coatings and Waterproofing, Inc.
   3. Note: fluid-applied air/vapor permitted for block only. Self-adhering sheet air barriers shall be used on weather-resistant gypsum sheathing.

B. If a fluid-applied air/vapor barrier membrane using above products is considered for application to weather-resistant gypsum sheathing, it shall be applied to achieve a dry film thickness not less than 60 mils thickness.

2.03 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air/vapor barrier manufacturer for intended use and compatible with air/vapor barrier. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air/vapor barrier material.

C. Counterflashing Strip: Modified bituminous 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, crosslaminated polyethylene film with release liner backing.
   1. Products:
      a. CCW-705-TWF; Carlisle Coatings & Waterproofing, Inc.
      b. Perm-A-Barrier Wall Flashing; Grace Construction Products.
      c. Blueskin TWF; Henry Company.

D. Butyl Strip for Transition at Single Ply Membrane Roofing: Vapor-retarding, 30- to 40-mil- thick, self adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.

E. Modified Bituminous Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

F. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.

G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

H. Adhesive and Tape: Air/vapor barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

J. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; initial R-Value (at 1 inch) of not less than 7; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

K. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 7 Section "Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that concrete has cured and aged for minimum time period recommended by air/vapor barrier manufacturer.
   3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   4. Verify that masonry joints are flush and completely filled with mortar.
   5. Weather-Resistant Gypsum Sheathing: Verify that boards are sufficiently stabilized with corners and edges fastened with appropriate screws at proper spacing.
   6. If unacceptable conditions are encountered, prepare written report, endorsed by Applicator, listing conditions detrimental to performance of work.
   7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

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

B. Mask off adjoining surfaces not covered by air/vapor barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
   1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

G. Fill gaps between different substrate systems; gaps between substrates and window, door, and storefront systems; and miscellaneous penetrations in substrates with sealant.
   1. Apply foam sealant in gaps up to 2 inches wide.

2. Apply insulation foam sealant in gaps greater the 2 inches wide.
3. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.
1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

I. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

J. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air/vapor barrier.

K. Concrete Masonry Unit Substrates:
1. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.
2. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
3. Prime with conditioning primer when installing modified asphalt membrane transition membranes. Apply primer at required rate and allow to dry. Limit priming to areas that will be covered by air/vapor barrier in same day. Reprime areas exposed for more than 24 hours.

3.03 INSTALLATION

A. Install modified bituminous sheets according to air/vapor barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.
1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air/vapor barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
2. Do not apply to wet or frozen substrates.
3. Do not allow contamination with dust or dirt.
4. Seal completely at edges, perimeter and penetrations.
5. Wrap membrane around perimeter of window openings, so the window systems can be caulked around the interior perimeter of opening, sealing between edge of window and air/vapor barrier.

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

D. Apply primer to substrates at required rate and allow to dry thoroughly. Adjust time for drying, based upon ambient temperature, humidity and weather conditions. Limit priming to areas that will be covered by air/vapor barrier sheet in same day. Reprime areas exposed for more than 24 hours.
1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air/vapor barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure airtight installation.
1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.

F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.

G. CMU: Apply fluid-applied air/vapor barrier in a continuous, uniform film using multiple, overlapping passes to achieve a dry film thickness not less than 60 mils thick.
   1. Inspect sprayed surfaces and fill any remaining gaps.
   2. Allow spray-applied membrane to cure to tack-free. Apply transition membrane with an overlap of not less than 3 inches onto each surface at all beams, columns and joints as indicated in detail drawings and on approved Shop Drawings.
      a. Tie in to door frames, storefront framing, roof and floor intersections, and changes in substrate.
      b. Seal top edge of transition membranes and flashing with termination mastic.

H. Seal top of through-wall flashings to air/vapor barrier sheet with an additional 6-inch- wide, counterflashing strip. Seal exposed top edge of counterflashing strip with bead of mastic as recommended by air/vapor barrier manufacturer.

I. Seal exposed edges of sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Install air/vapor barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air/vapor barrier.
   1. Coordinate the installation of air/vapor barrier with installation of roofing membrane and base flashing to ensure continuity of air/vapor barrier with roofing membrane.
   2. Install butyl strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.

K. Connect and seal exterior wall air/vapor barrier membrane continuously to roofing membrane air/vapor barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings using accessory materials as indicated.

L. Wall Openings: Prime concealed perimeter frame surfaces of windows, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
   1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.

M. At base of walls, apply air/vapor barrier to seal transition between top of foundation and wall. Apply air/vapor barrier to back and bottom of brick shelves, stopping barrier 1 inch back from outside face of foundation wall.

N. Fill gaps in perimeter frame surfaces of windows, storefronts, doors, and miscellaneous penetrations of air/vapor barrier membrane with foam sealant.

O. At end or each working day, seal top edge of membrane to substrate with termination mastic.

P. Apply joint sealants forming part of air/vapor barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

Q. Repair punctures, voids, and deficient lapped seams in air/vapor barrier. Slit and flatten fishmouths and blisters. Patch with air/vapor barrier sheet extending 6 inches beyond repaired areas in all directions.

R. Do not cover air/vapor barrier until it has been tested and inspected by inspection testing agency.

S. Correct deficiencies in or remove air/vapor barrier that does not comply with requirements; repair substrates and reapply air/vapor barrier components.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air/vapor barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air/vapor barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air/vapor barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed.
7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Air/vapor barrier has been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Remove and replace deficient air/vapor barrier components and retest as specified above.

3.05 CLEANING AND PROTECTION

A. Protect air/vapor barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air/vapor barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air/vapor barrier exposed to these conditions for more than 30 days.
2. Protect air/vapor barrier from contact with creosote, uncured coal-tar products, EPDM, and sealants not approved by air/vapor barrier manufacturer.

B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07271

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Fluid-applied membrane air barrier, vapor retarding.

1.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated

B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1. Include details of interfaces with other materials that form part of air barrier.

C. Product certificates.

D. Qualification data.

E. Product test reports.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly 150 sq. ft. (14 sq. m), incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.

1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.

2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.

C. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: synthetic polymer membrane.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Synthetic Polymer Membrane:

1) Grace, W. R. & Co.; Perm-A-Barrier Liquid.
2) or architectural approved equal

2. Physical and Performance Properties:

a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
b. Membrane Vapor Permeance: Not to exceed 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material.

C. Butyl Strip: Vapor-retarding, 30- to 40-mil- (0.76- to 1.0-mm-) thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

D. Modified Bituminous Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.

E. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

F. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

G. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft (24 to 32 kg/cu. m) density; flame spread index of 25 or less

according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

H. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.

I. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- (0.43-mm-) thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance of 37 perms (2145 ng/Pa x s x sq. m).

J. Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65-mil- (1.3- to 1.6-mm-) thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners.

K. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions.

B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

3.2 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.3 AIR BARRIER MEMBRANE INSTALLATION

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

B. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

C. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.

1. Vapor-Retarding Membrane Air Barrier: 60-mil (1.5-mm) dry film thickness.

F. Apply strip and transition strip a minimum of 1 inch (25 mm) onto cured air membrane or strip and transition strip over cured air membrane overlapping 3 inches (75 mm) onto each surface according to air barrier manufacturer's written instructions.

G. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

H. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.4 PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 60 days.

END OF SECTION 072726

SECTION 07311 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED SS Credit 7.2 – Use roofing materials having a Solar Reflectance Index (SRI) equal to or greater than 78 for a low-sloped roof where the slope is less than or equal to 2:12 or 29 for a steep-sloped roof where the slope is greater than 2:12.
LEED MR Credit 2.1 – Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
LEED MR Credit 2.2 – Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (referenced above) for a total of at least 75% of non-hazardous construction and demolition debris.
LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.

1. LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.

1.2 SUMMARY

A. This Section includes the following:

1. Asphalt shingles.
2. Felt underlayment.
3. Self-adhering sheet underlayment.
4. Ridge vents.

B. Related Sections include the following:
1. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings and counterflashings not part of this Section.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 SUBMITTALS

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

B. Samples for Initial Selection: For each type of asphalt shingle, ridge and hip cap shingles, ridge vent and exposed valley lining indicated.

1. Include similar Samples of trim and accessories involving color selection.

C. Samples for Verification: For the following products, of sizes indicated, to verify color selected.

1. Asphalt Shingle: Full-size asphalt shingle strip.
2. Ridge and Hip Cap Shingles: Full-size ridge and hip cap asphalt shingle.
3. Ridge Vent: 12-inch- (300-mm-) long Sample.
4. Exposed Valley Lining: 12 inches (300 mm) square.
5. Self-Adhering Underlayment: 12 inches (300 mm) square.

D. Qualification Data: For Installer, including certificate signed by asphalt shingle manufacturer stating that Installer is approved, authorized, or licensed to install roofing system indicated.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for asphalt shingles.

F. Research/Evaluation Reports: For asphalt shingles.

G. Maintenance Data: For asphalt shingles to include in maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual that is approved, authorized, or licensed by asphalt shingle roofing system manufacturer to install roofing system indicated.

B. Source Limitations: Obtain ridge and hip cap shingles through one source from a single asphalt shingle manufacturer.

C. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location according to asphalt shingle manufacturer's written instructions. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt shingle roofing to be performed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials[or workmanship] within specified warranty period. Materials failures include manufacturing defects and failure of asphalt shingles to self-seal after a reasonable time.

1. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first 5 years nonprorated.
2. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds up to 70 mph for 5 years from date of Substantial Completion.
3. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor five years from date of Substantial Completion.
4. Workmanship Warranty Period: 10 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Asphalt Shingles: 100 sq. ft (9.3 sq. m) of each type, in unbroken bundles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.

1. Available Products:

a. Owens Corning; Oak Ridges Pro 30 Shingles or architectural approved equal.
2. Strip Size: Manufacturer's standard.
3. Algae Resistance: Granules treated to resist algae discoloration.
4. Color and Blends: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226 or ASTM D 4869, Type I, asphalt-saturated organic felts, nonperforated.

B. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil-(1.0- mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied

1. Available Products:

a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "A."
b. Grace, W. R. & Co.; Grace Ice and Water Shield.
c. Henry Company; Perma-Seal PE.
d. Johns Manville International, Inc.; Roof Defender.
e. NEI Advanced Composite Technology; AC Poly Ice and StormSeal.
f. Owens Corning; WeatherLock M.
g. Polyguard Products, Inc.; Polyguard Deck Guard.
h. Protecto Wrap Company; Rainproof TM.
i. SafSeal Innovations; SafSeal 7740.

2.4 RIDGE VENTS

A. Rigid Ridge Vent: Manufacturer's standard rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and with external deflector baffles; for use under ridge shingles.

1. Available Products:

a. Air Vent Inc., a CertainTeed Company; ShingleVent II.
b. Cor-A-Vent, Inc.; V-Series.
c. GAF Materials Corporation; Cobra Rigid Vent II.
d. Globe Building Materials, Inc.; SmartAir Ridge Vent.
e. Lomanco, Inc.; OR-4.
f. Mid-America Building Products; RidgeMaster Plus.
g. Obdyke, Benjamin Incorporated; Xtractor Vent X18.
h. Owens Corning; VentSure Ridge Vent.
i. Ridglass Manufacturing Company, Inc.; Coolvent.
j. Solar Group, Inc. (The), a Gibraltar Company; PRV4.
k. Trimline Building Products; Trimline Ridge Vent.

2.5 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.

1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.

2.6 METAL FLASHING AND TRIM

A. Sheet Metal Flashing and Trim: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

1. Sheet Metal: Copper, Anodized aluminum.

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item.

1. Apron Flashings: Fabricate with lower flange a minimum of 5 inches (125 mm) over and 4 inches (100 mm) beyond each side of downslope asphalt shingles an 6 inches (150 mm) up the vertical surface.
2. Step Flashings: Fabricate with a headlap of 2 inches (50 mm) and a minimum extension of 5 inches (125 mm) over the underlying asphalt shingle and up the vertical surface.
3. Backer Flashings: Fabricate with concealed flange extending a minimum of 24 inches (600 mm) beneath upslope asphalt shingles and 6 inches (150 mm) beyond each side of chimney and 6 inches (150 mm) above the roof plane.
4. Drip Edges: See Division 7.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Single-Layer Felt Underlayment: Install single layer of felt underlayment on roof deck perpendicular to roof slope in parallel courses. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with felt underlayment nails.

1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches (75 mm) in direction to shed water. Lap ends of felt not less than 6 inches (150 mm) over self-adhering sheet underlayment.

METAL FLASHING INSTALLATION

B. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

C. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.

D. Step Flashings: Install with a headlap of 2 inches (50 mm) and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.

E. Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.

F. Rake Drip Edges: Install rake drip edge flashings over underlayment and fasten to roof deck.

G. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

H. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.3 ASPHALT SHINGLE INSTALLATION

A. Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches (175 mm) wide with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 1/2 inch (13 mm) over fascia at eaves and rakes.
2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

E. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full length first course followed by cut second course, repeating alternating pattern in succeeding courses.

F. Fasten asphalt shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.

1. Where roof slope exceeds 20:12, seal asphalt shingles with asphalt roofing cement spots after fastening with additional roofing nails.
2. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
3. When ambient temperature during installation is below 50 deg F (10 deg C), seal asphalt shingles with asphalt roofing cement spots.

G. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches (300 mm) beyond center of valley. Use one-piece shingle strips without joints in the valley. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches (50 mm) short of valley centerline. Trim upper concealed corners of cut-back shingle strips.

1. Do not nail asphalt shingles within 6 inches (150 mm) of valley center.
2. Set trimmed, concealed-corner asphalt shingles in a 3-inch- (75-mm-) wide bed of asphalt roofing cement.

H. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

I. Ridge Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 07311

SECTION 075323

MEMBRANE ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED SS Credit 7.2 – Use roofing materials having a Solar Reflectance Index (SRI) equal to or greater than 78 for a low-sloped roof where the slope is less than or equal to 2:12 or 29 for a steep-sloped roof where the slope is greater than 2:12.
LEED MR Credit 2.1 – Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
LEED MR Credit 2.2 – Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (referenced above) for a total of at least 75% of non-hazardous construction and demolition debris.
LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.

1. LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.

1.02 SUMMARY

A. This Section includes the following:
1. Adhered membrane roofing system.
2. Roof insulation related to membrane roofing.
3. Roof accessories and walkway pads.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 3 Section "Structural Precast Concrete" for precast plank roof deck.
3. Division 5 Section "Steel Deck" for deck to receive roof system.
4. Division 6 Section "Rough Carpentry" for material description and installation requirements for wood nailers, curbs, and blocking.
5. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
6. Division 15 for roof drains.

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1-inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
1. Fire/Windstorm Classification: Class 1A-60.

D. Roof flashing details shall be consistent with those shown on the Drawings. Where cap flashing is shown, a standard manufacturer's bar anchor only detail is not acceptable. Membrane manufacturer's recommended flashing detail may be considered by the Architect when no detail is provided.

1.05 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For each type of product indicated. Provide installation instructions and general recommendations from manufacturer of EPDM membrane system for types of roofing materials required.

C. Shop Drawings: Submit shop drawings for roofing system approved by the manufacturer showing roof configuration, sheet layout, seam locations, details at perimeter, penetration and flashing details, attachments to adjacent Work, and special conditions. Customized detail sheets shall be prepared by manufacturer, showing each condition and approved installation method conforming with the construction drawing constraints and details.
1. Base flashings and membrane terminations.
2. Layout of tapered insulation and cricket materials, including slopes.
3. Insulation fastening patterns.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
1. Submit evidence of meeting performance requirements.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
1. Insulation Test Reports: Evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor

transmission, water absorption, and other properties, based on comprehensive testing of current products.

H. Maintenance Data: For roofing system to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

J. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

K. LEED-Required Submittals per Division 1 Section 018113.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Shall be approved, authorized, factory trained, and licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty. Contractor shall have a minimum of 3 years experience installing the system, have installed a minimum of 500,000 square feet and shall employ personnel experienced and skilled in the application of the manufacturer's roofing system.
1. Work associated with EPDM membrane roofing, including (but not limited to) wood blocking and nailers associated with roofing, insulation, flashing, and membrane sheet joint sealers, shall be performed by Installer of this Work.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for membrane roofing system identical to that used for this Project.

C. Source Limitations for Roofing Products: Obtain components for membrane roofing system from same manufacturer as roofing membrane or as approved by roofing membrane manufacturer.

D. Source Limitations for Insulation Products: Obtain each type of roof insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
1. Insulation shall be approved by roofing manufacturer for use with roofing system for a total system warranty.

E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

F. Insulation Fire Performance Characteristics: Provide insulation and related materials with the fire-test-response characteristics specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface Burning Characteristic: ASTM E 84.
2. Fire Resistance Ratings: ASTME E 119.
3. Combustion Characteristics: ASTM E 136.

G. Roofing work shall be applied in strict accordance with the provisions of the specification criteria. No deviations shall be permitted without written consent from the Architect. Should a conflict between this specification and the manufacturer's requirements arise, the most restrictive provision as determined by the Architect shall govern.

H. Upon completion of the installation, an inspection shall be made by the system manufacturer to ascertain that the roofing system has been installed according to the applicable manufacturer's specifications and details. No "early bird" warranty will be accepted. The results of the warranty inspection shall be submitted in writing to Contractor and Architect for their review and records.

I. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories, and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates 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. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
11. Provide 72-hour minimum advance notice to participants prior to convening preinstallation conference.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components. Comply with the manufacturer's written instructions for proper material storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Insulation and protection board shall be stored on pallets, at least 4 inches off the ground and tightly covered with waterproof, "breathable" materials. Insulation shall be protected from direct sunlight.

E. Materials, which are damaged, shall be removed and replaced at the Installer's expense.

F. Materials shall be delivered in sufficient quantity to allow continuity of the Work.

G. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

H. Do not overload any portion of the building, either by use of or placement of equipment, storage of debris, or storage of materials. The loads of construction shall not exceed 25 pounds per square foot.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.

C. Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition. All surfaces shall be smooth, dry, clean, free of fins or sharp edges, loose or foreign materials, oil or grease. No work shall proceed when moisture is present on the roof or in the substrate materials.

D. Temporary waterstops shall be installed at the end of each workday and shall be removed before proceeding with the next day's work.

E. If the exterior walls are not erected at the time of membrane installation, envelop the flutes of the metal deck to prevent moisture intrusion and wind damage.

1.09 WARRANTY

A. General: The special warranties specified in this Section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Roofing Contractor shall furnish to the Owner the manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
   1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, walkway products, and other components of membrane roofing system.
   2. Warranty Period: 15 years from date of Project Substantial Completion.

C. No "Early Bird" warranties shall be issued.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 ROOFING MEMBRANE

A. EPDM Roofing Membrane: ASTM D 4637, Type I, nonreinforced uniform, flexible sheet made from EPDM, and as follows:
   1. Manufacturers:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products Company.
   2. Thickness: 60 mils, nominal.
   3. Exposed Face Color: Black.

2.03 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive.

D. Sheet Seaming System: Manufacturer's standard splice tape for sealing lapped joints.

E. Lap Sealant: Manufacturer's standard single-component sealant.

F. Membrane Adhesive: As recommended by membrane manufacturer for particular substrate and project conditions.
   1. Provide adhesives that comply with local requirements limiting amounts of volatile organic compounds.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

I. Crickets and Flashing Accessories: Types recommended by membrane manufacturer, including adhesive tapes, flashing cements, and sealants.
   1. Crickets: Johns Manville tapered factory pre-cut crickets, extending to roof drain sumps, 1/2-inch taper.

J. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

K. Miscellaneous Accessories: Provide preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

L. Roof walkways shall be pre-molded 2'-6" x 2'-6" rubber walkways as supplied by the membrane manufacturer.

2.04 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces, 4 feet by 4 feet board size, CAN/ULC S770 Grade 2, 25 psi minimum, LTTR R-values.
   1. Products:
      a. Polyiso HP-H; Carlisle SynTec Incorporated.
      b. Hy-Therm AP; Celotex Corporation.
      c. ISO 95+; Firestone Building Products Company.
      d. E'nrg'y 2; Johns Manville International, Inc.
   2. Provide roofing manufacturer's required insulation for total system warranty.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.
   1. Tapered insulation shall meet requirements specified for board roof insulation. Provide tapered boards where indicated for sloping to drains. Tapered insulation shall be manufactured by same manufacturer of board roof insulation.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.05 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Adhesive for Bonding Insulation: Manufacturer's standard adhesive, complying with fire-resistant requirements, formulated to adhere roof insulation to concrete substrate.
   1. Firestone I.S.O. Fix Adhesive.
   2. Carlisle Sure-Seal FAST 100 Adhesive.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced.
   2. Verify that wood blocking, curbs, and nailers are securely anchored.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section "Steel Deck."
   4. Verify that concrete substrate is visibly dry and free of moisture. Test for moisture in accordance with manufacturer's requirements.
   5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with manufacturer's instructions to prepare substrate to receive EPDM membrane roof system.

B. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

D. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Install acoustical roof deck rib insulation strips, specified in Division 5 Section "Steel Deck," according to acoustical roof deck manufacturer's written instructions.

F. Prime substrate where recommended by manufacturer of materials being installed.

3.03 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation in two layers under area of roofing to achieve required thickness. Install layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction with no gaps, to form a complete thermal envelope.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
1. Verify proper air and deck temperatures before start of installation.
2. Apply beads of adhesive to the concrete roof deck and previous layers of roof insulation in accordance to the roofing manufacturer's pattern and coverage rate.
3. Attach each layer of insulation with adhesive.

H. Mechanically Fastened Insulation (Wood and Metal Deck): Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification, but in no case, provide less than one anchor per 4 sq. ft. of surface area.
   a. In no case shall there be less than 2 fasteners per piece of insulation.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
3. Screws shall be installed utilizing automatic, positive clutch disengaged and adjustable nosepiece.
4. Fasteners which require pre-drilling shall be drilled to a minimum depth as recommended by the fastener manufacturer or required by Factory Mutual to permit full seating of fastener into plate.
5. Tapered insulation shall be mechanically attached using same procedures noted above.

I. Do not install more insulation in a day than can be covered with membrane before end of day or before start of inclement weather.

3.04 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
1. Cut out and repair membrane defects at the end of each day's work.

C. Fully Adhered Membrane: Install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer. Apply adhesive to surfaces to be bonded and roll into place when adhesive has properly cured. Adhere seams with splicing tape and apply sealant to exposed sheet

edges, tapering application as recommended by manufacturer. Install mechanical fasteners, flashings and counterflashings, and accessories at locations and as recommended by manufacturer.

1. Flashing details shall be done in accordance with the approved shop drawings. Base flashing shall be properly terminated and covered with counterflashing, providing not less than a 4-inch overlap.
2. Apply 6-inch wide strip of uncured EPDM to all field sheet seams, which will underlie walkway.

D. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.

E. Repair tears, voids, and lapped seams in roofing that do not meet requirements.

F. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.05 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.06 WALKWAY INSTALLATION

A. Rubber Roof-Paver Walkway: Install rubber roof-paver walkways according to manufacturer's written instructions in locations indicated. Install roof-paver walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc.) and all locations as identified on the Drawings.

3.07 ROOF DRAIN INSTALLATION

A. Roof Drain System: Install roof drain and accessories in strict accordance with manufacturer's written instructions, providing a permanent weather tight installation.

1. Inspect and determine substrate to be in satisfactory condition, with deck fully anchored and aligned at proper location and elevation. All surfaces shall be smooth, dry, clean, free of sharp edges, and other irregularities.
2. Attach deck flange securely to substrate.
3. Assemble and flash gravel stop flange into roof system per roof system and roof drain manufacturer requirements.
4. Securely attach strainer basket.

3.08 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Roofing Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Contractor.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07531

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR Credit 2.1 – Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
LEED MR Credit 2.2 – Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (referenced above) for a total of at least 75% of non-hazardous construction and demolition debris.
LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Manufactured through-wall flashing.
2. Manufactured reglets.
3. Formed low-slope roof flashing and trim.
4. Formed steep-slope roof flashing and trim.
5. Formed equipment support flashing.

B. Related Sections include the following:
1. Division 01 Section "Sustainable Design Requirements"
2. Division 03 Section "Cast-in-Place Concrete" for installing reglets.
3. Division 04 Section "Unit Masonry" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
4. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
5. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
6. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
   1. Windload: Per Drawings.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

   1. Identify material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
   4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

   1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

   1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, **[cleats,]** [**clips,**] closures, and other attachments.

2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

E. LEED-Required Submittals per Division 1 Section 018113.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."

B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including built-in gutter and fascia, approximately 48 inches (1200 mm) long, including supporting construction cleats, seams, attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. 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.

2.2 SHEET METALS

A. Copper Sheet: 16 oz. ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Mill Finish: Standard one-side bright - 3 coat Kynar finish.
2. Alclad Finish: Metallurgically bonded surfacing to both sides, forming a composite aluminum sheet with reflective luster.

3. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with AAMA 2605.

      1) Color: As selected by Architect from manufacturer's full range and to match windows.

      2)

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

1. Finish: No. 2D (dull, cold rolled).

D. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).

1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.

E. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

F. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Exposed Finishes: Apply the following coil coating:

a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

a) Humidity Resistance: 1000 hours.

2) Color: As selected by Architect from manufacturer's full range and matches windows.

G. Lead Coated Copper Copper Sheathing. Provide copper panels and all necessary accessories from a single source and of compatible materials. Provide all accessories required for a complete warranteed system.

1. Type: 3/4" Lap Seam.
2. Material: 6 ounce copper.
3. Panels may be shop formed to custom fit curvature of the substrate.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226 or ASTM D4869, Type I, asphalt-saturated organic felts, nonperforated.

C. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D1970 minimum of 40-mil (1.0- mm-) thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied.

D. Available Manufacturers:
1. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "A:.
2. Grace, W.R. & Co.; Grace Ice and Water Shield
3. Henry Company; Perma-Seal PE.
4. Johns Manville International, Inc.; Roof Defender
5. NEI Advanced Composite Technology; AC Poly Ice and StormSeal.
6. Ownes Corning; WeatherLock M.
7. Polyguard Products, Inc.; Polyguard Deck Guard.
8. Protecto Wrap Company; Rainproof TM
9. SafSeal Innovations; SafSeal 7740

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch (2.8 mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.

C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Solder for Lead-Coated Copper: ASTM B 32, Grade Sn60, 60 percent tin and 40 percent lead.

E. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

F. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

H. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.

1. Copper: 16 oz. minimum for fully concealed flashing; 16 oz. (0.55 mm thick) elsewhere.

a. Available Products:

1) Advanced Building Products Inc.; Cop-R-Loc Interlocking Flashing.
2) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).
3) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
4) Dur-O-Wal, Dayton Superior Corporation; Polytite Copper Flashing.
5) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
6) Sandell Manufacturing Company, Inc.; Three-Way Saw Tooth Flashing.
7) York Manufacturing, Inc.; Cop-R-Loc Interlocking Flashing.

B. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.

1. Available Manufacturers:

a. Cheney Flashing Company, Inc.
b. Fry Reglet Corporation.
c. Heckmann Building Products Inc.
d. Hickman, W. P. Company.
e. Keystone Flashing Company, Inc.
f. Sandell Manufacturing Company, Inc.

2. Material: Stainless steel, 0.0187 inch (0.5 mm) thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Counterflashing: Fabricate from one of the following material:
1. Aluminum: 0.0320 inch (0.8 mm) thick.

H. Roof-Penetration Flashing: Fabricate from the following material:
1. Lead-Coated Copper: 17.2 oz./sq. ft. (0.60 mm thick).

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following material:
1. Coated Aluminum: 0.0320 inch (0.8 mm) thick.

B. Drip Edges: Fabricate from the following material:
1. Coated Aluminum: 0.0320 inch (0.8 mm) thick. Dark color to match roof.

C. Counterflashing: Fabricate from the following material:
1. Aluminum: 0.0320 inch (0.8 mm) thick.

D. Roof-Penetration Flashing: Fabricate from the following material:
1. Lead-Coated Copper: 17.2 oz./sq. ft. (0.60 mm thick).

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
   1. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch (0.7 mm) thick.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

   1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

   1. Coat side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with **[elastomeric] [butyl]** sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.
3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
4. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel and aluminum sheet.
2. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.

3. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
4. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
5. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch (400-mm) centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 07720

ROOF ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes:
1. Roof hatches
2. Gutter drain
3. Metal Soffit

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 5 Section "Metal Fabrications" for ladders and miscellaneous metal framing and supports.
3. Division 6 Section "Rough Carpentry" for wood cants, and wood nailers.
4. Division 7 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, fascia, and miscellaneous sheet metal trim and accessories.
5. Division 7 Sections for roofing accessories included as part of roofing Work.

1.03 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For each type of product indicated. Submit manufacturer's detailed technical product data, installation instructions and recommendations. Include construction details, materials, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Show fabrication and installation details. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, rough-in requirements, elevations, sections, details, and attachments to other Work.

1.04 QUALITY ASSURANCE

A. Standards: Comply with the following:
1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Aluminum Sheet: ASTM B 209 for alclad alloy 3005H25 or alloy and temper required to suit forming operations, with mill finish, unless otherwise indicated.

B. Extruded Aluminum: ASTM B 221 alloy 6063-T52 or alloy and temper required to suit structural and finish requirements, with mill finish, unless otherwise indicated.

C. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thickness indicated.

D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for above ground use, complying with AWPA C2; not less than 1-1/2 inches thick.

E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.
   1. Where removing exterior exposed fasteners affords access to building, provide nonremovable fastener heads.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

G. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.

H. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

I. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

2.02 ROOF HATCHES

A. Roof Hatches: Fabricate units to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loading pressure. Frame with minimum 9-inch- high, integral-curb, double-wall construction with 1-1/2-inch insulation, formed cants and cap flashing (roofing counterflashing), with welded or sealed mechanical corner joints. Provide double-wall cover (lid) construction with 1-inch- thick insulation core. Provide gasketing and equip with corrosion-resistant or hot-dip galvanized hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles.
   1. Manufacturers:
      a. Bilco Company.
      b. Milcor, Inc.
      c. Nystrom Products Co.
   2. Type: Single-leaf personnel access.
      a. For Ladder Access: 30 by 36 inches.
   3. Material: Aluminum, sheets and extrusions.
   4. Finish: Mill.

B. Ladder Extension Post: Telescoping tubular section fabricated from hop dipped galvanized steel that attaches to fixed ladder below hatch and that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel balancing mechanism.
   1. Manufacturer: Bilco Company.

2.03 GUTTER DRAINS

1. Drain: Zurn C125 or architectural approved equal.

2.03 METAL SOFFIT SYSTEM

A. Manufacturer: Pac- Clad www.pac-clad.com or architectural approved equal.

B. Type: Flush Panel.

2.04 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written instructions and recommendations. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," and per manufacturer's specification unless otherwise indicated.

C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.

E. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.02 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 07720

SECTION 078413

THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.02 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:
1. Floors.
2. Roofs.
3. Walls and partitions.
4. Smoke barriers.
5. Construction enclosing compartmentalized areas.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 3 Section "Cast-in-Place Concrete" for construction of openings in concrete slabs and walls.
3. Division 7 Section "Building Insulation" for safing insulation and accessories.
4. Division 7 Section "Sprayed Fire-Resistive Materials."
5. Division 7 Section "Fire-Resistive Joint Systems."
6. Division 15 Sections specifying duct and piping penetrations, including fire-suppression piping. Firestopping is included as part of Division 15 filed sub-bids.
7. Division 16 Sections specifying cable and conduit penetrations. Firestopping is included as part of Division 16 filed sub-bid.

1.03 PERFORMANCE REQUIREMENTS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.
4. Fire-resistance-rated roof assemblies.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
1. Penetrations located outside wall cavities.
2. Penetrations located outside fire-resistive shaft enclosures.
3. Penetrations located in construction containing fire-protection-rated openings.
4. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
4. Products in public areas shall be paintable.

E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

F. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per UL 2079, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For each type of through-penetration firestop system product indicated. List product characteristics, typical uses, performance and limitation criteria, and test data.
1. Include manufacture's installation procedures for each type of product.

C. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Indicate which firestop materials will be used where and thickness for different hourly ratings.

Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
3. For those firestop applications that exist for which no UL tested system is available through a manufacturer, manufacturer's engineering judgement derived from similar UL system design or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Manufacturer's engineering judgement shall follow the requirements set forth by the International Firestop Council.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

F. Product Test Reports: From an independent qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

G. LEED-Required Submittals per Division 1 Section 018113.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests shall be performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.

b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
   1) UL in "Fire Resistance Directory."
   2) ITS in "Directory of Listed Products."

D. Provide through-penetration firestop system products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

E. Field-Testing: Each type of through-penetration firestop system shall be field-tested.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.08 COORDINATION

A. Coordinate the Work of this Section with the work of other trades to assure the proper sequencing of each installation and to provide a smoke- and fire-resistant installation.

B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

D. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

E. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Bio Fireshield, Carlisle, MA.
   2. W. R. Grace & Co., Construction Products Division.
   3. Hilti Construction Chemicals, Inc.
   4. Isolatek International.
   5. Nelson Firestop Products.
   6. Specified Technologies Inc.
   7. 3M Fire Protection Products.

2.02 FIRESTOPPING, GENERAL

A. Firestop Systems: All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire-resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
   1. Provide paintable firestop products at locations exposed to the public. Mechanical, electrical and elevator machine rooms are not considered public spaces.

B. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

C. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-/rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

2.03 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the UL or Warnock Hersey tested assembly.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

1. Product:
   a. CP 680 Cast-In-Place Firestop Device; Hilti Construction Chemicals, Inc.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
   1. Product:
      a. Biostop 500+ Intumescent Firestop; Bio Fireshield.
      b. FlameSafe FS900 Sealant; W. R. Grace & Co.
      c. Fire Barrier CP 25WB+; 3M Fire Protection Products.
      d. SpecSeal LC 150 Sealant; Specified Technologies Inc.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
   1. Product:
      a. Biostop Pipe Collar; Bio Fireshield.
      b. FlameSafe FSWS Series FlameSafe Devices; W. R. Grace & Co.
      c. CP 642 and CP 643 Firestop Jacket; Hilti Construction Chemicals, Inc.
      d. SpecSeal Series LCC and Series SSC Firestop Collars; Specified Technologies Inc.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
   1. Product:
      a. Biostop Composite Sheet; Bio Fireshield.
      b. CS-195 Composite Sheet; 3M Fire Protection Products.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
   1. Product:
      a. FlameSafe FSP 1000 Putty and FSP 1077 Putty Pads; W. R. Grace & Co.
      b. CP 617 and CP 618 Putty Pads and Putty Sticks; Hilti Construction Chemicals, Inc.
      c. MPS-2 Moldable Putty Stix and Putty Pads; 3M Fire Protection Products.
      d. Spec-Seal Firestop Putty Bars and Putty Pads; Specified Technologies Inc.

G. Intumescent Wrap Strips with Foil: Single-component intumescent elastomeric sheets with aluminum foil on one side.
   1. Product:
      a. CP 645 Wrap Strips; Hilti Construction Chemicals, Inc.
      b. Fire Barrier FS-195+ Wrap Strip; 3M Fire Protection Products.

H. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets.
   1. Product:
      a. Biostop Wrap Strip; Bio Fireshield.
      b. SpecSeal Series SSWBLU and Series SSWRED Intumescent Wrap; Specified Technologies Inc.

I. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
   1. Product:
      a. FlameSafe Mortar Safe; W. R. Grace & Co.
      b. CP 636 Firestop Mortar; Hilti Construction Chemicals, Inc.

c. SpecSeal Firestop Mortar; Specified Technologies Inc.

J. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
1. Product:
   a. Bio Firestop Pillows; Bio Fireshield.
   b. FlameSafe Bags and FlameSafe Pillows; W. R. Grace & Co.
   c. CP 651 Firestop Cushion; Hilti Construction Chemicals, Inc.
   d. SpecSeal Firestop Pillows; Specified Technologies Inc.

K. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
1. Product:
   a. CP 620 Firestop Foam; Hilti Construction Chemicals, Inc.
   b. Fire Barrier 2001 Silicone RTV Foam; 3M Fire Protection Products.
   c. SpecSeal Pen 200 Silicone Foam; Specified Technologies Inc.

L. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
   a. Product:
      1) Biotherm 200SL Firestop Sealant; Bio Fireshield.
      2) CP 604 Self-Leveling Firestop Sealant; Hilti Construction Chemicals, Inc.
      3) Fire Barrier 1003SL; 3M Fire Protection Products.
      4) SpecSeal Pen 300 Silicone Sealant; Specified Technologies Inc.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
   a. Product:
      1) Biotherm 200SL Firestop Sealant; Bio Fireshield.
      2) CP 604 Self-Leveling Firestop Sealant; Hilti Construction Chemicals, Inc.
      3) Fire Barrier 1003SL; 3M Fire Protection Products.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.
   a. Product:
      1) Biotherm 100 Firestop Sealant; Bio Fireshield.
      2) CP 601S Elastomeric Firestop Sealant; Hilti Construction Chemicals, Inc.

M. Accessories: Forming/damming materials composed of mineral fiberboard or other type as recommended by through-penetration firestop systems manufacturer.

2.04 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner may engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
   1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.

B. Allow for 3 random samples of each type of firestopping system to be inspected. Reinstall disturbed samples to comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

D. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.05 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07841

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.02 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
   1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Construction and control joints in cast-in-place concrete.
      b. Joints between architectural precast concrete units and between architectural precast concrete units and adjacent materials.
      c. Control and expansion joints in unit masonry.
      d. Joints between metal panels.
      e. Joints between different materials listed above.
      f. Perimeter joints between materials listed above and frames of doors, windows and louvers.
      g. Control joints in ceilings and other overhead surfaces.
      h. Other joints as indicated.
   2. Exterior joints in the following horizontal traffic surfaces:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Other joints as indicated.
   3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
      e. Joints on underside of plant-precast structural concrete planks.
      f. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
      g. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      h. Other joints as indicated.
   4. Interior joints in the following horizontal traffic surfaces:
      a. Isolation and control joints in exposed cast-in-place concrete slabs.
      b. Control and expansion joints in tile flooring.
      c. Other joints as indicated.

B. Related Sections include the following:
   1. Division 1 Section "Sustainable Design Requirements"
   2. Division 2 Sections for sealing joints in pavements, walkways, and curbing.
   3. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.

4. Division 7 Section "Sheet Metal Flashing and Trim" for sealing joints related to flashing.
5. Division 7 Section "Through-Penetration Firestop Systems" for sealing penetrations in fire-resistance-rated construction.
6. Division 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
7. Division 8 Section "Glazing" for glazing sealants.
8. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
9. Division 9 Section "Ceramic Tile" for sealing tile joints.
10. Divisions 15 and 16 for sealing of perimeter joints of plumbing, HVAC systems, automatic fire protection systems, telecommunication systems, and electrical systems.

1.03 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For each joint-sealant product indicated.

C. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Qualification Data: For Installer.

E. LEED-Required Submittals per Division 1 Section 018113.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in materials, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, shelf/pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Remove and replace materials, at no cost to Owner, that cannot be applied within their stated shelf life.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation to ensure a weathertight installation.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 JOINT SEALANTS

A. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Type S, Grade NS, Class 25; single component.
1. Sonolastic NP-1; Sonneborn, Division of ChemRex Inc.
2. Dymonic; Tremco, Inc.
3. Sikaflex-1a; Sika Corporation, Inc.
4. Dynatrol 1; Pecora Corporation.
5. Vulkem 116; Tremco, Inc.
6. Chem-Calk 900; Bostik Findley.

B. Type 2 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Type M, Grade NS, Class 25; two-component.
1. Sonolastic NP-2; Sonneborn, Division of ChemRex Inc.
2. Dymeric 240/240FC; Tremco, Inc.
3. Sikaflex-2c, NS; Sika Corporation, Inc.
4. Dynatrol 2; Pecora Corporation.
5. Vulkem 922; Tremco, Inc.
6. Chem-Calk 500; Bostik Findley.

C. Type 3 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
1. Tremflex 834; Tremco, Inc.
2. AC-20; Pecora Corporation.
3. Chem-Calk 600; Bostik Findley.

D. Type 4 - Plumbing Fixture/Tile Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant, color selected by Architect.
1. Sanitary SCS 1700; GE Silicones.
2. 898 Silicone; Pecora Corporation.

3. 786 MR Silicone; Dow Corning Corporation.
4. Tremsil 200; Tremco, Inc.

E. Type 5 - Acoustical Sealant: Specified in Section 09260.

F. Type 6 - Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C920, Grade P, Class 25, Uses T, M and A; single component.
1. Sonolastic SL-1; Sonneborn, Division of ChemRex Inc.
2. Sikaflex-1CSL; Sika Corporation, Inc.
3. Vulkem 45/45SSL; Tremco, Inc.

2.03 JOINT-SEALANT BACKING

A. General: Provide sealant backings (backer rods) of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers (Backer Rods): Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.04 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for

sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean concrete, masonry unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where indicated or recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings (Backer Rods): Install sealant backings to comply with the following requirements:

1. Install sealant backings of type indicated to provide support of sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   a. Do not leave gaps between ends of joint fillers.
   b. Do not stretch, twist, puncture, or tear joint fillers.
2. Install bond-breaker tape behind sealants where sealant backings (backer rods) are not used between sealants and backs of joints.

D. Installation of Sealants: Install sealants using proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

A. Control, Expansion, and Soft Joints in Masonry and Between Masonry and Adjacent Work: Type 2; colors as selected.

B. Exterior Joints Between Precast Concrete Units: Type 2; colors as selected.

C. Joints between Exterior Metal Frames and Adjacent Work (Except Masonry): Type 2; colors as selected.

D. Under Exterior Door Thresholds: Type 1.

E. Exterior Joints for Which No Other Sealant Type is Indicated: Type 2; colors as selected.

F. Concealed Interior Perimeter Joints of Exterior Openings: Type 1.

G. Exposed Interior Perimeter Joints of Exterior Openings: Type 3; colors as selected.

H. Interior Ceramic Tile Expansion, Control, Contraction, and Isolation Joints in Horizontal Traffic Surfaces: Type 2; color as selected.

I. Control and Expansion Joints in Interior Concrete Slabs and Floors Left Exposed: Type 6; colors as selected.

J. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls: Type 4; colors as selected.

K. Interior Joints for Which No Other Sealant is Indicated: Type 3; colors as selected.

END OF SECTION 07920

SECTION 081100

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR Credit 2.1 – Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
LEED MR Credit 2.2 – Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (referenced above) for a total of at least 75% of non-hazardous construction and demolition debris.
LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.

1.02 SUMMARY

A. This Section includes steel doors and steel frames.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 4 Section "Unit Masonry Assemblies" for building anchors into and grouting steel frames in masonry construction.
3. Division 8 Section "Glazing" for glazed lites in steel doors and frames.
4. Division 8 Sections for door hardware and weatherstripping for steel doors.
5. Division 9 painting Sections for field painting steel doors and frames.
6. Division 16 for electrical service and connections of electrified door hardware and controls.

1.03 DEFINITIONS

A. Minimum Steel Sheet Thickness: Minimum thickness of base metal without coatings.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 013300.
1. Submittals for Sections 081100, 082110, and 087100 shall be made concurrently.

B. Product Data: Include door designation, type, level and model, construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.

C. Shop Drawings: In addition to requirements below, provide a schedule of steel doors and frames using same reference numbers for details and openings as those on Drawings:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details.
   3. Frame details for each frame type, including dimensioned profiles.
   4. Details and locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, accessories, joints, and connections.
   7. Details of glazing frames and stops showing glazing.
   8. Details of conduit and preparations for electrified door hardware and controls.

D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

E. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of steel door and frame.

F. Material Certificates: Signed by manufacturers certifying that each fire-rated door complies with requirements.

G. LEED-Required Submittals per Division 1 Section 018113.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain steel doors and frames through one source from a single manufacturer.

B. Fire-Rated Door Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
   1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
      a. Location: CMCC.
   2. Test Pressure: Test according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
      a. Location: EMCC and SMCC.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Inspect doors and frames on delivery for damage; notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

D. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
   1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.07 COORDINATION

A. Coordinate installation of anchorages for steel frames. 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 masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door Products; a United Dominion Company.
2. CURRIES Company; an ASSA ABLOY Group Company.
3. Steelcraft; an Ingersoll-Rand Company.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B; with minimum A40 zinc-iron-alloy (galvannealed) coating designation.

D. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153, Class B.

E. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel door frames of type indicated.

G. Grout: Comply with Division 4 Section "Unit Masonry Assemblies."

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Division 8 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8, unless more stringent requirements are specified.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board with internal sound deadener on inside of face sheets, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
   a. Fire Door Core: As required to provide fire-protection ratings indicated.
   b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 11.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363, unless otherwise indicated.
      1) Locations: Exterior doors.
3. Vertical Edges for Doors: Beveled edge.
   a. Beveled Edge: 1/8 inch in 2 inches.
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick end closures or channels of same material as face sheets.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).

D. Hardware Reinforcement: Fabricate reinforcement plates of sufficient strength from same material as door face sheets to support hardware without through bolting and to comply with the following minimum sizes:
   1. Hinges: Minimum 0.123 inch thick (10 gage) by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   2. Pivots: Minimum 0.167 inch thick (8 gage) by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick (8 gage).
   4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick (8 gage).

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
   1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
   2. Frames for Level 3 Steel Doors: 0.067-inch- thick (14 gage) steel sheet, unless otherwise indicated.

C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
   1. Fabricate frames with mitered or coped and welded face corners and seamless face joints for pairs of doors.
   2. Fabricate knocked-down frames with mitered or coped corners at single leaf door openings, for field assembly.
   3. Frames for Level 2 Steel Doors: 0.053-inch- thick (16 gage) steel sheet, unless otherwise indicated.
   4. Frames for Wood Doors: 0.053-inch- thick (16 gage) steel sheet, unless otherwise indicated.

5. Frames for Borrowed Lights: 0.042-inch- thick (18 gage) steel sheet, unless otherwise indicated.
6. All welded joints shall be ground and dressed to be smooth, flush, and invisible.

D. Hardware Reinforcement: Fabricate reinforcement plates of sufficient strength from same material as frames to support hardware without through bolting and to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch thick (10 gage) by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch thick (8 gage) by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick (14 gage).
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick (14 gage).
5. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Supports and Anchors: Fabricated from not less than 0.042-inch thick (18 gage) electrolytic zinc-coated or metallic-coated steel sheet.

F. Jamb Anchors:
1. Masonry Type: T-shaped anchors to suit frame size, not less than 0.042 inch thick (18 gage).
2. Metal Stud-Wall Type: Slip in wood stud anchor equal to Curries M series; not less than 0.053 inch thick (16 gage).

G. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick (18 gage), and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

I. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick (28 gage) steel sheet to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

2.05 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick (20 gage), fabricated from same material as door face sheet in which they are installed.
1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

B. Fixed Frame Moldings: Formed integral with steel frames, minimum 5/8 inch high, unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick (20 gage), fabricated from same material as frames in which they are installed.

D. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.06 FABRICATION

A. General: Fabricate steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Steel Doors:

1. Exterior Doors: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch-thick (16 gage), metallic-coated steel channels with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.
2. Interior Door and Panel Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from cold-rolled steel sheet, unless otherwise indicated.
3. Pairs of Doors: Size of pairs of doors to provide maximum 3/16-inch gap between leafs to permit proper functioning of dead latching feature.
4. Glazed Lites: Factory cut openings in doors.

C. Steel 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; grind smooth and invisible.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
4. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
5. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor. Provide floor anchors for all frames.
7. Jamb Anchors: 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:
    a. Masonry Type:
        1) Two anchors per jamb up to 60 inches in height.
        2) Three anchors per jamb from 60 to 90 inches in height.
        3) Four anchors per jamb from 90 to 120 inches in height.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 120 inches in height.

    b. Stud-Wall Type:
        1) Three anchors per jamb up to 60 inches in height.
        2) Four anchors per jamb from 60 to 90 inches in height.
        3) Five anchors per jamb from 90 to 96 inches in height.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof more than 96 inches in height.
        5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
8. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to 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.
9. Provide welded frames with temporary spreader bars for shipping.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware. Through bolting will not be acceptable.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   4. Provide loose stops and moldings on inside of doors and frames.
   5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

F. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.07 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Apply primers to steel doors and frames after assembly.

B. Comply with SSPC-PA1, "Paint Application Specification No. 1," for steel sheet finishes.

C. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of steel doors and frames.
   1. Examine roughing-in for embedded and built-in anchors to verify actual locations of steel frame connections before frame installation.
   2. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Paint backside of frames to be set in masonry with bituminous coating.

C. Prior to installation, adjust and securely brace steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

D. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Steel Frames: Install standard steel frames for doors, sidelights, transoms, borrowed lights, and other openings, of size and profile indicated. Comply with SDI 105.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable glazing stops located on secure side of opening.
      d. Install door silencers in frames before grouting.
      e. Remove shipping straps at bottom of frames. Properly space frame using wood template that is full depth of frame and of proper spacing width during setting and anchoring of frames to maintain proper width, with frame plumb and square without twists. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      g. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors. Floor anchors are in addition to wall anchors.
      a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Metal-Stud Partitions: Attach wall anchors to studs with screws. Provide floor anchor at each jamb, in addition to the wall anchors.
   4. Masonry Walls: Anchors shall be masonry T-shaped anchors. Provide floor anchor at each jamb, in addition to the wall anchors. Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
   5. Installation Tolerances: Adjust steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

6. Mineral Fiber Insulation: Fill head and jambs of frames scheduled to receive sound seals with mineral fiber insulation.

C. Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.
4. Pairs of Doors: Install pairs of doors to provide maximum 3/16-inch gap between leafs and accurate alignment of strike to permit proper functioning of dead latching feature.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with steel door and frame manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Remove and replace defective work, including steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off steel doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

END OF SECTION 08110

SECTION 082110

WOOD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:
LEED MR Credit 2.1 – Recycle and/or salvage at least 50% of non-hazardous construction and demolition debris.
LEED MR Credit 2.2 – Recycle and/or salvage an additional 25% beyond MR Credit 2.1 (referenced above) for a total of at least 75% of non-hazardous construction and demolition debris.
LEED MR 7 - All wood products, project-wide: Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principle and Criteria for wood building components. These components include, but are not limited to, temporary fencing, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.
LEED EQ Credit 4.4 – Composite wood and agrifiber products used on the interior of the building (defined as inside of the weatherproofing system) shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

1.02 SUMMARY

A. This Section includes the following:
1. Solid-core doors .
2. Factory finishing wood doors.
3. Factory glazing of fire-rated wood doors with glazed openings.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 8 Section "Glazing" for glass view panels in wood doors.

1.03 SUBMITTALS

A. General: Submit in accordance with Section 01330.
1. Submittals for Sections 08110, 08211, and 08710 shall be made concurrently.

B. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications. Include door manufacturer's storage, handling, finish, installation, and maintenance instructions.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; face veneer, construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

D. Door Schedule: Submit schedule of doors using same reference numbers for details and openings as those on Contract Drawings.
1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

E. Samples: Submit the following:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

F. LEED-Required Submittals per Division 1 Section 018113.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

C. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors" or AWI's "Architectural Woodwork Quality Standards Illustrated."

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated.
1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
   a. Location: CMCC.
2. Test Pressure: Test according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
   a. Location: EMCC and SMCC.
   b. EMCC currently does not have any wood doors, but if a rated wood door is added, it will need to comply with this requirement.
3. Acceptable Fire-Rating Label: Underwriters' Laboratories, Inc. (U.L.) or Warnock Hersey.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standard, manufacturer's instructions, and recommendations of NWWDA I.S. 1, Appendix, "How to Store, Handle, Finish, Install and Maintain Wood Doors."

1. Package doors at factory prior to shipping.
2. Protect doors from extremes of heat and cold. Relative humidity shall not be less than 30 percent nor more than 60 percent.
3. Compare pre-finished doors to approved finish sample upon delivery. Notify Architect if sample does not match.

B. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.07 WARRANTY

A. General: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist), show telegraphing of core construction in face veneers, and which do not conform to tolerance limitations of specified quality standards.
1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
   a. Solid-Core Interior Doors: Life of installation.
   b. Interior Stile and Rail Doors: Life of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Wood Doors:
   a. Algoma Hardwoods Inc.
   b. Eggers Industries; Architectural Door Division.
   c. Marshfield Door Systems, (Weyerhaeuser).
   d. VT Industries Inc.
2. Flush wood doors and interior stile and rail doors shall be provided by the same manufacturer.

2.02 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:
1. Grade: Premium, with Grade A faces.

2. Species and Cut: Natural white birch, rotary cut.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Running match.
5. Match: Provide door faces of compatible color and grain for doors hung in same opening or separated only by mullions.
6. Stiles: Same species as faces or a compatible species.

2.03 SOLID-CORE DOORS

A. Interior Veneer-Faced Doors:
1. Core: Particleboard for flush wood doors; structural composite lumber core for stile and rail doors.
2. Construction: Five plies, hot pressed, with stiles and rails bonded to core, then entire unit abrasive planed before veneering. No substitution.

B. Fire-Rated Doors:
1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals..

2.04 INTERIOR STILE AND RAIL DOORS

A. Stile and Rails: 5 ply construction with solid hardwood edges and sticking to match face veneer.

B. Core: Structural composite.

C. Stile and Rail Widths: As indicated.

D. Molding Profile: Manufacturer's standard.

E. Glass for Openings: As indicated; complying with Division 8 Section "Glazing."

2.05 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:
1. Wood Species: Same species as door faces.
2. Profile: Same shape as beads for light openings in fire-rated doors.
3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in

doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

1. Glazing beads for rated and non-rated doors shall have the same profile.

C. Glazing in Fire-Rated Doors: Wire glass, ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality q8 (glazing); 6 mm (0.23 inch) thick minimum.
   1. Form 1 (wired glass, polished both sides).
   2. Pattern: Mesh 2 (M2) (Square).
   3. Location: CMCC and SMCC.

2.06 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
   1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
   2. Coordinate sizing of pairs of doors to provide maximum 3/16-inch gap between leafs to permit proper functioning of dead latching feature.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
   1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
   1. Light Openings: Trim openings with moldings of material and profile indicated.

D. Factory glaze fire-rated doors with light openings.

2.07 FACTORY FINISHING

A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated," Section 1500 for factory finishing.

B. Finish doors at factory.

C. Transparent Finish:
   1. Grade: Custom.
   2. Finish: AWI System, TR-6 catalyzed polyurethane.
   3. Staining: None required.
   4. Sheen: Satin.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."
1. Hinges shall be shimmed with metal shims at each door to provide equal clearance at each jamb.
2. Locks, exit devices, door closers and other hardware shall be installed in accordance with the manufacturer's instructions. Pilot holes of recommended size, for wood screws required to fasten the hardware, shall be drilled by the installing Contractor before screws are fastened to the wood doors.

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08211

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
LEED IEQ Credit 4.2 – Paints and coatings used on the interior of the building and applied on-site must comply with the following VOC criteria:

1. Architectural paints, coatings and primers applied to interior walls and ceiling are not to exceed VOC limits in Green Seal Standard GS-11 (5/20/1993); Flats 50 g/L, Non-Flats 150 g/L.
2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates are not to exceed VOC content of 250 g/L per Green Seal Standard GC-03 (1/7/1997).
3. Clear wood finishes, floor coatings, stains, sealers and shellacs applied to interior are not to exceed VOC limits per South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings (1/1/2004); Clear wood finishes – Varnish 350 g/L, Lacquer 550 g/L; Floor coatings 100 g/L; Sealers – Waterproofing sealers 250 g/L, Sanding sealers 275 g/L, All other sealers 200 g/L; Shellacs – Clear 730 g/L, Pigmented 550 g/L; Stains 250 g/L.

1.2 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for anchoring and grouting access door frames set in masonry construction.
2. Division 07 Section "Roof Accessories" for roof hatches.
3. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
4. Division 09 Section "Acoustical Tile Ceilings" for suspended acoustical tile ceilings.

5. Division 23 Section "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

F. LEED-Required Submittals per Division 1 Section 018113.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 for vertical access doors and frames.
2. ASTM E 119 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

1. ASTM A 123/A 123M, for galvanizing steel and iron products
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

C. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating in damp locations; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

    a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

F. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 ALUMINUM MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness indicated representing specified thickness according to ANSI H35.2 (ANSI H35.2(M)).
   1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written specifications for cleaning, conversion coating, and painting.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Bar-Co, Inc. Div.; Alfab, Inc.
4. Cendrex Inc.
5. Dur-Red Products.
6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
7. Jensen Industries.
8. J. L. Industries, Inc.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. MIFAB, Inc.
12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

B. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead flange.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Self-latching bolt operated by screwdriver with interior release.

C. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Fire-Resistance Rating: Not less than that indicated.
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead.
6. Hinges: Concealed-pin type.

7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by knurled knob with interior release.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
   1. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
   2. Provide mounting holes in frames for attachment of units to metal or wood framing.
   3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 084110

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Exterior and interior aluminum-framed storefronts.
      a. Glazing is retained mechanically with gaskets on four sides.
      b. Subframe for exterior aluminum-framed storefronts.
   2. Exterior and interior manual-swing aluminum doors.
   3. Exterior and interior aluminum door frames.
   4. Operable units in storefront.
   5. Single hung aluminum windows.
   6. Break metal in conjunction with frames.
   7. Door hardware.
   8. Sealant at interior and exterior perimeter of storefront.

B. Related Sections include the following:
   1. Division 1, Section "Sustainable Design Requirements".
   2. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
   3. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
   4. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
   1. Structural loads.
   2. Thermal movements.
   3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   4. Dimensional tolerances of building frame and other adjacent construction.
   5. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferred to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
      d. Noise or vibration created by wind and thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.
      g. Failure of operating units to function properly.

B. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
   2. Seismic Loads: As indicated on Drawings.
   3. Code: As indicated.

C. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Seismic Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7-98, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever are more stringent.

F. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

G. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft..

H. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 62 when tested according to AAMA 1503.

J. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.44 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
   1. Submit replacement parts lists, adjustment instructions, and maintenance requirements for all components and hardware.

C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
   3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
   4. Indicate fastener layout and size for transferring loads back to supporting structure.

D. Samples:
   1. Sealants: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

E. Welding certificates.

F. Qualification Data: For Installer signed by manufacturer certifying that Installers comply with requirements in "Quality Assurance" Article.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

H. Manufacturer's Field Reports: Manufacturer's field service representative shall submit field inspection report of product installation to Architect.

I. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
   1. Include maintenance manuals for hardware provided in this Section.

J. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section, who is acceptable to manufacturer, and is able to obtain specified manufacturer's warranty.
   1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of glazed storefront systems that are similar to those indicated for this Project in material, design, and extent.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Source Limitations: Obtain each type of aluminum-framed entrance, window, and storefront from one source and by a single manufacturer.

1. Aluminum-framed entrances and storefront systems specified in this Section and curtain wall system specified in Division 8 Section "Glazed Aluminum Curtain Wall" shall be from same manufacturer.

E. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

F. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

G. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to glazed aluminum storefront and entrance systems including, but not limited to, the following:
1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review structural loading limitations.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required inspecting, testing, and certifying procedures.
5. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
6. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
7. Provide 72-hour minimum advance notice to participants prior to convening preinstallation conference.

H. Field Quality Control: Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instruction. Upon completion of installation, manufacturer's field representative shall prepare written report on installation of systems.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Coordinate rough opening, masonry opening, and wood blocking requirements.

1.07 WARRANTY

A. General: Special warranties specified in this Section shall not deprive Owner of other rights Owner may have under other provisions of Contract Documents and will be in addition to and run concurrent with other warranties made by Contractor under requirements of Contract Documents.

B. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Failure of system to meet performance requirements.
   c. Noise or vibration caused by thermal movements.
   d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   e. Adhesive or cohesive sealant failures.
   f. Water leakage through fixed glazing and framing areas.
   g. Failure of operating components to function properly.
   h. Glazing breakage.
2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Kawneer Company, Inc.:
      a. Exterior Storefront and Entrances: 451T frames with 350 Heavy Wall Entrances and Frames.
      b. Interior Storefront and Entrances: 451 frames with 350 Heavy Wall Entrances and Frames.
   2. Vistawall Architectural Products:
      a. Exterior Storefront and Entrances: Series 3000 poured and debridged Thermal Storefront System with Rugged MS Entrances and Frames.
      b. Interior Storefront and Entrances: Series 3000 with Rugged MS Entrances and Frames.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.
   5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011.

2.03 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Fixed, center-plane systems as follows:
      a. Exterior Framing Members: Composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.
      b. Interior Framing Members: Nonthermal.
   2. Provide thermally broken extruded aluminum sill flashing with end dams for storefronts.
   3. Provide thermally broken extruded aluminum subframes for storefronts.
   4. Provide operable units (windows and doors) manufactured by storefront system manufacturer.
   5. Provide components having face width indicated on Drawings.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
   1. Provide extra-heavy reinforcement for hinges and closers at doors over 7'-0" in height.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   2. Reinforce members as required to receive fastener threads.
   3. Do not use exposed fasteners, except for hardware application. For hardware application, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system or hardware being fastened, unless otherwise noted. Exposed fasteners shall be stainless steel.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Aluminum Break Metal: Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness, not less than 0.125-inch thick, to maintain a flat appearance without visible deflection.

G. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.04 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, extruded EPDM rubber gaskets, fabricated to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

C. Spacers and Setting Blocks: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

D. Provide framing system gaskets, sealants, and joint fillers recommended by manufacturer for joint type.

E. Sealants and Joint Fillers: Provide for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."

2.05 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual and power-assisted swing operation.
   1. Door Construction: 2-inch overall thickness, with minimum 0.188-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
   2. Door Design: Medium stile; 3-1/2-inch nominal width, 10-inch high bottom rail, and 6-inch cross rail.
   3. Door Frame: Minimum 0.188-inch thick, extruded aluminum; 2-inch by 4-1/2 inch profile, stop with weatherstripping; run heavy weight jambs full height of opening.
   4. Glazing Stops and Gaskets: Manufacturer's heavy weight removable mullion with weatherstripping, finish to match frame.
      a. Provide nonremovable glazing stops on outside of exterior doors.

2.06 DOOR HARDWARE

A. General: Provide heavy-duty units in sizes, numbers, and types recommended by entrance system and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish, unless otherwise indicated. Provide specified manufacturers without substitution.
   1. Opening-Force Requirements:
      a. Egress Doors: Not more than 30 lbf required to set door in motion and not more than 15 lbf required to open door to minimum required width.
      b. Accessible Interior Doors: Not more than 5 lbf.

B. Continuous, Geared-Type Hinges: Heavy-duty, extruded-aluminum, pinless, geared hinge leaves; joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating, stainless steel thrust bearings between knuckles; fabricated to full height of door and frame; finished to match door.
   1. Provide minimum 4-wire power transfer for doors with electric exit devices.

C. Removable Mullion Meeting Stile: Provide at exterior pairs of doors, steel tube, paint finish to match aluminum..
   1. Standard: BHMA A156.3.

D. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC. Provide at head and jamb of all exterior doors.

E. Weather Sweeps: Manufacturer's standard exterior door bottom sweep with concealed fasteners on mounting strip.

F. Thresholds: Raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch. Coordinate cutouts for operating hardware with anchors and jamb clips.
   1. Material: Aluminum, mill finish.

G. Balance of Hardware: See Division 8 Section "Door Hardware."

2.07 OPERABLE WINDOW UNITS

A. Projected Windows: Provide manufacturer's thermally broken, top-hinged, outward swinging window designed for use in storefront system. Finish to match storefront system.
   1. Kawneer: GlassVent.
   2. Vistawall: ZS 2750.

B. Window Hardware: Provide the following:
   1. Operator: Cam operator and locking.
   2. Hinges: Comply with AAMA 904; concealed four-bar friction hinge with adjustable-slide friction shoe; two per ventilator.
   3. Weatherstipping: Manufacturer's standard compressible, replaceable weatherstripping designed for permanently sealing under bumper action around full perimeter of unit, and completely concealed when ventilator is closed.

2.08 ALUMINUM WINDOWS

A. Window Type: Single hung, thermally-broken windows with subframe, meeting the following:
   1. Performance Class and Grade: HC-45.
   2. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.
   3. Thermal Transmittance: Provide aluminum windows with a whole-window, U-factor maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503.
   4. Finish: To match storefront.

B. Hardware and Weather Stripping: Provide the following:
   1. Sash Balance: Concealed, spring-loaded, block-and-tackle type, Class 5, to hold sash stationary at any open position; two per sash.
   2. Handle: Continuous, integral, sash lift bar on bottom rail of forward-placed operating sash.
   3. Sash Lock: Cam-action sweep lock and keeper on meeting rail; on sash wider than 36 inches provide two per sash.

4. Safety Devices: Provide sash stop in balance track to limit clear opening to 8 inches for ventilation at single hung units. Provide keyed custodial locks to prevent unauthorized tilting of sash.
5. Weather Stripping: Provide woven-pile, full-perimeter weather stripping for each operable sash, unless otherwise indicated. Comply with AAMA 701/702.

C. INSECT SCREENS
1. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on outside of double hung windows and provide for each operable exterior sash.
   a. Comply with SMA 1004, "Specifications for Aluminum Tubular Frame Screens for Windows," for minimum standards of appearance, fabrication, attachment of screen fabric, hardware, and accessories unless more stringent requirements are indicated.
   b. Location: On interior side of awning windows and on exterior of single hung units.
2. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
   a. Extruded-Aluminum or Aluminum Tubular Framing Sections and Cross Braces: Not less than 0.050-inch wall thickness.
   b. Finish: Match aluminum storefront and window members, unless otherwise noted.
3. Aluminum Wire Fabric: 18-by-16 mesh of 0.011-inch- diameter, coated aluminum wire.
   a. Wire-Fabric Finish: Charcoal gray.

2.09 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.10 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Doors: Reinforce doors as required for installing hardware.
1. At exterior doors, provide weather sweeps applied to door bottoms and compression weather stripping at fixed stops.

G. Windows: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact. Fabricate units that are reglazable without dismantling sash or ventilator framing.
1. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
2. Provide full-perimeter weather stripping for each operable sash and ventilator.

H. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed and field-installed hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
1. Color and Gloss: .Color to be selected by Architect from manufacturer's full range of warm and cool whites to match vinyl windows and glazed aluminum curtain walls.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation. Install sills in one piece, full width of opening except where opening exceeds available manufactured lengths. Provide sealed metal end dams at ends of sills. Sills shall turn up on backside to form pan, directing water to the exterior.

E. Secure subframes to opening framing. Caulk exterior perimeter with backer rod and sealant. Caulk around interior perimeter between frame and the air/vapor barrier with backer rod and sealant.

F. Install components plumb and true in alignment with established lines and grades, without warp or rack.

G. Install glazing as specified in Division 8 Section "Glazing."

H. Entrances and Windows: Install to produce smooth operation and tight fit at contact points.
1. Exterior Entrances and Windows: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
3. Install hardware furnished in Division 8 Section "Door Hardware."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation. Color of sealant to match aluminum finish.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.03 ADJUSTING AND CLEANING

A. Entrances and Windows: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.
1. Provide tight fit at contact points and weather stripping. Provide smooth operation and weathertight closure. Frame shall be free from distortion.

B. Remove excess sealant and glazing compounds and dirt from surfaces. Remove nonpermanent labels and clean surfaces.

3.04 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures entrances and storefront systems are without damage or deterioration at time of Substantial Completion.

END OF SECTION 08411

SECTION 085413 - FIBERGLASS WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes All Ultrex® Impervia (or other architectural approved equal) single hung window complete with hardware, glazing, weather strip, insect half screen, grilles-between-the glass, jamb extension, sheet rock return, j-channel, and standard or specified anchors, trim and attachments. Types include:
1. Fixed
2. Double hung or single hung
a. Where double hungs are shown, single hung are acceptable

1.3 Related Sections:

1. Division 1 Section "Sustainable Design Requirements"

1.3 DEFINITIONS

A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:

1. AW: Architectural.
2. HC: Heavy Commercial.
3. C: Commercial.
4. LC: Light Commercial.
5. R: Residential.

B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

1. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

D. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size indicated below:
   1. Size indicated on Drawings.

B. Structural Performance: Provide windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:

   1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

      a. Basic Wind Speed: see drawings.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

   1. Mullion details, including reinforcement and stiffeners.
   2. Joinery details.
   3. Expansion provisions.
   4. Flashing and drainage details.
   5. Weather-stripping details.
   6. Glazing details.
   7. Window cleaning provisions.
   8. For installed products indicated to comply with design loads, include structural analysis data prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of windows, and used to determine structural test pressures and design pressures from basic wind speeds indicated.

C. Samples for Initial Selection: For units with factory-applied color finishes.

   1. Include similar Samples of hardware and accessories involving color selection.

D. Samples for Verification: For windows and components required, prepared on Samples of size indicated below.

   1. Main Framing Member: 12-inch- (300-mm-) long, full-size sections of window frame with factory-applied color finish.

2. Window Corner Fabrication: 12-by-12-inch- (300-by-300-mm-) long, full-size window corner including full-size sections of window frame with factory-applied color finish, weather stripping, and glazing.
3. Operable Window: Full-size unit with factory-applied finish.
4. Hardware: Full-size units with factory-applied finish.

E. Product Schedule: For windows. Use same designations indicated on Drawings.

F. Qualification Data: For Installer manufacturer and testing agency.

G. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency for each type, class, grade, and size of window. Test results based on use of downsized test units will not be accepted.

H. Maintenance Data: For windows and finishes to include in maintenance manuals.

I. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to window manufacturer for installation of units required for this Project.

1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of data for windows, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain windows through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of windows and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to windows including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of windows with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

K. Regulatory Requirements: Emergency Egress or Rescue: Comply with requirements for sleeping units of [IBC International Building Code] [BOCA Basic Building Code] [Southern Building Code] [Uniform Building Code].

1.7 DELIVERY

A. Comply with provisions of Section 01 65 00.

B. Deliver in original packaging and protect from weather.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.9 WARRANTY

A. Windows shall be warranted to be free from defects in manufacturing, materials, and workmanship for a period of ten (10) years from purchase date.

B. Window glass shall be warranted to be free from defects in manufacturing, materials and workmanship for period of twenty (20) years from the purchase date.

1.10 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. E 283: Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
   2. E 330: Standard Test Method for Structural Performance of Exterior Windows, Curtains Walls, and Doors by Uniform Static Air Pressure Difference.
   3. E 547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
   4. E 774: Specification for Sealed Insulated Glass Units.
   5. C 1036: Standard Specification for Flat Glass.

B. Sealed Insulating Glass Manufactures Association / Insulating Glass Certification Council (SIGMA / IGCC).

C. American Architectural Manufacturers Association / Window and Door Manufacturers Association (AAMA / WDMA):
   1. ANSI/AAMA/NWWDA 101 / I.S.2-97: Voluntary Specifications for Aluminum, (PVC) and Wood Windows and Glass Doors.
   2. 101/I.S. 2/NAFS-02: Voluntary Performance Specification for Windows, Skylights and Glass Doors/

D. Window and Door Manufacturers Association (WDMA): Hallmark Certification Program.

E. American Architectural Manufacturers Association (AAMA): 613: Voluntary Performance Requirements and Test Procedures for Organic Coatings on Plastic Profiles.

F. National Fenestration Rating Council (NFRC): 101: Procedure for Determining Fenestration Product Thermal Properties.

1.11 SYSTEM DESCRIPTION

A. Design and Performance Requirements:
   1. Window units shall be designed to comply with ANSI / AAMA / NWWDA 101 / I.S.2-97 and 101 / I.S. 2/ NAFS-02
      a. Single Hung: (H-LC50) (H-LC30)
      b. Transom: (TR-C50)
      c. Picture: (F-C50)
   2. Air leakage shall not exceed the following when tested at 1.57 according to ASTM E 283: .0.3 cfm per square foot of frame.
   3. No water penetration shall occur when units are tested at the following pressure according to ASTM E 547:
      a. Single Hung: (H-LC50 – 7.5 psf) (H-LC30 – 4.5 psf)
      b. Transom: (TR-C50-7.5 psf)

c. Picture: (F-C50-7.5 psf)

4. Units shall be designed to comply with ASTM E330 for structural performance when tested at the following pressures:
   a. Single Hung: (H-LC50 - 75 psf) (H-LC30 - 45 psf)
   b. Transom: (TR-C50-75 psf)
   c. Picture: (F-C50-75 psf)

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Ultrex® Impervia Single Hung (and related stationary or picture units) as manufactured by Integrity Windows and Doors, Fargo, North Dakota.

2.2 MATERIALS

2.1 FRAME DESCRIPTION

A. Interior: Reinforced fiberglass minimum 0.065 – 0.070 inch (2 mm) thick.

B. Frame width: Manufacturers' standard.

2.3 SASH DESCRIPTION

A. Manufactures' standard.

2.4 GLAZING

A. Select quality complying with ASTM C 1036. Insulating glass SIGMA/IGCC certified to performance level CBA when tested in accordance with ASTM E 774.

B. Glazing method: 3/4 inch (19 mm) Insulated glass.

C. Glass type: Low E II - Argon gas.

D. Glazing seal: Silicone bedding at exterior and interior.

2.5 FINISH

A. Color: Architect to choose from Manufacturers standard.

2.6 HARDWARE

A. Balance System: Coil spring block and tackle with nylon cord and glass filled nylon shoe and steel locking shoe.

B. Jamb Track: Pultrusion.

C. Lock: High pressure zinc die-cast cam lock and keeper.
1. Finish: Phosphate coated and electrostatically painted. Color: White.

2.7 WEATHER STRIP

A. Sill weather strip is foam filled bulb. The bottom sash is sealed to the jambs using rigid with flexible seals. The top stationary sash seal is foam tape. The checkrails are sealed using rigid with flexible seals.

2.8 JAMB EXTENSION

A. Standard: 2". Furnish jamb extension: factory installed.

2.9 INSECT HALF SCREEN

A. Factory installed half screen. Screen mesh, 18 by 16: Charcoal fiberglass.

B. Frame finish: match windows.

2.10 GRILLES-BETWEEN-THE-GLASS (GBG)

A. Manufactures' standard
1. Colors: match windows.

2.11 ACCESSORIES AND TRIM

A. Installation Accessories:
1. Factory installed nailing fin at head, sill and side jambs.
2. Installation brackets: Brackets for 4-9/16 inch (116 mm); 6-9/16 inch (167 mm) jambs.
3. Sheet rock return.
4. J-channel.
5. Mullion kit: per drawing.

2.3 INSECT SCREENS

A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Fabricate insect screens to fully integrate with window frame. Locate screens on outside of window and provide for each operable exterior sash or ventilator.

1. Provide Manufacturers standard screen

2.4 FABRICATION

A. Fabricate windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.

1. Double-Hung and single hung Windows: Provide weather stripping only at horizontal rails of operable sash.

C. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch- (1.6-mm-) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Provide manufacturer's standard finish to match window units. Provide subframes capable of withstanding design loads of window units.

D. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.

E. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

F. Hardware: Mount hardware through double walls of extrusions or provide corrosion-resistant steel reinforcement complying with requirements for reinforcing members, or do both.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.1 EXAMINATION

A. Verification of Conditions: Before Installation, verify openings are plumb, square, and of proper dimension as required in Section 01 71 00. Report frame defects or unsuitable conditions to the General Contractor before proceeding.

B. Acceptance of Conditions: Beginning of installation confirms acceptance of existing conditions.

3.2 INSTALLATION

A. Comply with Section 01 73 00.

B. Assemble and install window unit according to manufacturer's instructions and reviewed shop drawings.

C. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07 92 00 Joint Sealants. Do not use expansive foam sealant.

D. Install accessory items as required.

E. Use finish nails to apply wood trim and mouldings.

3.3 CLEANING

A. Remove visible labels and adhesive residue according to manufacturer's instructions.

B. Leave windows and glass in a clean condition. Final cleaning as required in Section 01 74 00.

3.4 PROTECTING INSTALLED CONSTRUCTION

A. Comply with Section 01 76 00.

B. Protect windows from damage by chemicals, solvents, paint, or other construction operations that may cause damage.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 085313

SECTION 087100 – FINISH HARDWARE, ACCESS CONTROL, LOW VOLTAGE WIRING

PART 1 –GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 DESCRIPTION OF WORK

A. The work of this section includes, but is not limited to, the following:

1. Providing hardware for all doors, except doors provided with their own hardware.
2. Providing lock cylinders for all work requiring cylinders.
3. Providing the services of a qualified hardware consultant to prepare detailed schedules of hardware required for the project.
4. Provide all low voltage wire and wiring for access control system. Locate card access controller in Data Room 010.

1.03 RELATED WORK

A. Carefully examine all of the Contrast Documents for requirements which affect the work of this section. Other specifications sections which directly relate to the work of this section include, but are not limited to, the following:

1. Section 08100 – Hollow Metal Doors and Frames; work requiring template coordination, metal astragals for fire-rated doors.
2. Section 08210 – Wood Doors; work requiring template coordination, metal astragals for fire-rated doors.

1.04 INTENT

A. A major intent of the work of this section is to provide hardware for every door in the project, except as indicated, so that each door functions correctly for its intended use. Provide only hardware that complies with applicable codes and requirements of authorities having jurisdiction including requirements for barrier–free accessibility.

1.05 QUALITY ASSURANCE

A. Hardware supplier shall have in his employ one or more members of the Door and Hardware Institute to include at least one Certified Architectural Hardware Consultant in good standing, who shall be responsible for preparation of the Finish Hardware Schedule. This Consultant shall be acceptable to the Architect and is to ensure that the intent requirement of this specification is fulfilled, and certify that the work of this section meets or exceeds the requirements specified in this section and the requirements of authorities having jurisdiction.

B. Hardware supplier shall warrant and guarantee, in writing, that hardware supplied is free of defective material and workmanship. Supplier shall further warrant and guarantee for a period of one year from Owner's Use and Occupancy that the hardware shall function in a satisfactory manner without binding, collapse, or dislodging of its parts, provide the installation is made to the manufacturer's recommendations.

C. The hardware supplier shall repair of remedy, without charge, any defect of workmanship or material for which he is responsible hereunder.

1.06 SUBMITTALS

A. Submit the following in accordance with SECTION 01300-SUBMITTALS:

1. Schedule: Submit to the Architect six (6) copies of the complete hardware schedule within the fourteen (14) days after receipt of contract award. Submit therewith complete catalog cuts and descriptive data of all products specifically scheduled therein. No materials shall be ordered or templates issued until the hardware schedule has been approved by the Architect. Form and detail of hardware schedule shall be in vertical format in conformance to the door and hardware industry standards. All hardware sets shall be clearly cross-referenced to the hardware set numbers listed in the specifications.

2. Samples: If requested, submit to the Architect for approval, a complete line of samples as directed. Samples shall be plainly marked giving hardware number used in this specification, the manufacturer's numbers, types and sizes. The Architect will deliver approved samples to the project site to be stored. Samples will remain with the Architect until delivery of all hardware to the project is complete, after which time they will be turned over to the General Contractor for incorporation into the work.

3. Keying System Submission: Before cylinders are ordered, submit a complete proposed keying system for approval. This should be done after a keying meeting has been held with the owner's representative.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of hardware shall be made to the project by the Hardware Supplier in accordance with the instructions of the General Contractor.

B. The finish hardware shall be delivered to the jobsite and received there by the General Contractor. The General Contractor shall prepare a locked storage room with adequate shelving, for all hardware. The storage room shall be in a dry, secure area, and shall not include storage of other products by other trades.

C. The General Contractor shall furnish the Hardware Supplier with receipts for all hardware and accessory items received, and shall send copies of these receipts to the Architect, if requested.

1.08 REGULATORY REQUIREMENTS

A. Conform to all applicable codes. Provide all throws, projections, coatings, knurling, opening and closing forces, and other special functions required by State and Local Building Codes, and all applicable Handicap Code requirements.

B. For fire rated openings, provide hardware complying with NFPA 80 and NFPA 101 without exception. Provide only hardware tested by UL for the type and size of door installed and fire resistance rating required.

1.09 SPECIAL REQUIREMENTS

A. Hardware Supplier shall determine conditions and materials of all doors and frames for proper application of hardware.

B. The Hardware Schedule shall list the actual product series numbers. Bidders are required to follow the manufacturers' catalog requirement for the actual size of door closers, brackets and holders. All door opening sizes are as noted on the Door Schedule and all hardware shall be in strict accordance with requirements of height, width, and thickness.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Hinges	McKinney Stanley	Scranton, PA New Britain, CT
Locksets	Schlage (No exception)	Colorado Springs, CO
Exit Devices	Sargent Von Duprin	New Haven, CT Indianapolis, IN
Door Closers	Sargent LCN	New Haven, CT Princeton, IL
Door Stop	Glynn Johnson Ives Rockwood	Indianapolis, IN New Haven, CT Rockwood, PA

Push/Pulls	Rockwood	Rockwood, PA
	Burns	Erie, PA
	Ives	New Haven, CT
Protective Plates	Rockwood	Rockwood, PA
	Burns	Erie, PA
	Ives	New Haven, CT
Thresholds/ Weatherstripping/ Rain Drips	NGP	Memphis, TN
	Pemko	Memphis, TN
	Reese	Rosemount, MN
Silencers	Ives	New Haven, CT
	Glynn Johnson	Indianapolis, IN
	Rockwood	Rockwood, PA

2.02 MATERIALS AND QUALITY

A. All hardware shall be of the best grade of solid metal entirely free from imperfections manufacturer and finish.

B. Qualities, weights, and sizes given herein are the minimum that will be accepted. It is the responsibility of the Hardware Supplier to supply the specified size and weight of hardware and the proper function of hardware in each case and to provide UL approved hardware at all fire rated doors.

C. Provide, as far as possible, locks of one lock manufacturer and hinges of one hinge manufacturer. Modifications to hardware that are necessary to conform to construction shown or specified shall be provided as required for the specified operation and functional features.

2.03 HARDWARE DESIGNATIONS

A. All items of hardware are referenced by manufacturer's names and numbers. The manufacturer's names and numbers are used to define the function, design, and the quality of the material to be supplied.

Substitution of products other than those listed shall be submitted to the Architect at least ten (10) days PRIOR to the bid date. The Architect shall be the sole judge of any proposed substitution.

2.04 TEMPLATES

A. Hardware supplier shall immediately, but not later than three (3) days after approval of his Schedule by the Architect, furnish the General Contractor with complete template information necessary for the fabrication of doors, frames, etc. No templates shall be furnished prior to the approval of the hardware schedule.

2.05 HARDWARE FOR LABELED FIRE DOORS, EXIT DEVICES AND SMOKE DOORS

A. Hardware shall conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Labeling and listing by UL Building Materials Directory, for class of door being used will be accepted as evidence of conformance to these requirements. Install minimum latch throw as specified on label of individual doors. Provide hardware listed by UL except where heavier materials, larger sizes, or better grades are specified herein under paragraph entitled "Hardware Sets". In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may b e submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements. Specific hardware requirements of door or frame manufacturers which exceed sized or weights of hardware herein listed shall be provided with no additional charge.

2.06 KEYS AND KEYING

A. The hardware supplier shall review the specific hardware functions with the Architect and owner at the time of the keying review, to assure the appropriateness of each of the hardware functions. Failure to make this review does not relieve the hardware supplier from providing the proper functions.

B. Key System: All cylinders shall be Masterkeyed and/or Grandmaster Keys: Furnish six (6) keys for each set, if required.

1. Master keys, Grandmaster Keys: Furnish six (6) keys for each set, if required.

2. Furnish three (3) change keys for each cylinder keyed differently; six (6) change keys for each set keyed alike, and in sets where only (2) cylinders are keyed alike, four (4) change keys will be required.

3. All keying is to be done at the factory to avoid duplication of the new cylinders.

4. Master Keys shall be sent to the Owner by registered mail, return receipt required.

5. Supply a bitting list for all change keys and master keys to the Owner.

6. All lock cylinders shall be set to Construction key for use by the Contractor during the construction period. Furnish ten (10) Construction keys and two (2) voiding the Construction key feature.

2.07 FASTENERS

A. Manufacture hardware to conform to published templates, generally prepared for machine screw installation.

B. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Furnish exposed screws to match the hardware finish, or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, except as otherwise indicated.

C. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard manufactured units of the type specified are available with concealed fasteners. Do not use thru-bolts unless specifically approved by the Architect.

D. All hardware shall be installed only with fasteners supplied by manufacturers of specific products.

2.08 PACKING AND MARKING

A. All hardware shall have the required screws, bolts and fastenings necessary for proper installation and shall be wrapped in the same package as the hardware item for which it is intended and shall match finish of hardware with which to be used.

B. Each package shall be clearly labeled indicating the portion of the work for which it is intended.

2.09 ENVIROMENTAL CONCERN FOR PACKGING

A. The hardware shipped to the jobsite is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping. If non-biodegradable packing such as plastic, plastic bags or large amounts of Styrofoam is utilized, then the Contractor will be responsible for the disposal of the non-biodegradable packing to a licensed or authorized collector for recycling of the non-degradable packing.

2.10 FINISH HARDWARE DESCRIPTION

A. Hardware items shall conform to respective specifications and standards and to requirements specified herein.

B. MATERIALS AND FINISH MATERIALS AND FINISHES SHALL BE:

1. Interior Butts: US26D (BHMA 652)
2. Exterior Geared Hinges US28 (BHMA 628)
3. Door Closers: Sprayed to match hardware finish.
4. Exit Devices: US26D (BHMA 626)
5. Kick, Push Plates: US32D (BHMA 630)
6. All other hardware shall be: US26D (BHMA 626), or as scheduled.

C. HINGES

1. Number of hinges per door, two hinges for doors up to and including five feet in height and an additional hinge for each two and one half feet or fraction thereof.

2. Hinges shall be as follows:

Exterior	McKinney	TA2314	4 ½ x 4 ½ NRP
	Stanley	FBB191	4 ½ x 4 ½ NRP
Interior	McKinney	TA2714	4 ½ x 4 ½
	Stanley	FBB179	4 ½ x 4 ½
Elec	McKinney	TA2714-CC4	
	Stanley	CEFBB179	

D. DOOR CLOSERS:

1. Door closers shall have fully hydraulic, full rack and pinion action. Cylinder body shall be 1-1/2" in diameter, and double heat treated pinion shall be 11/16" in diameter.

2. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

3. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.

4. All closers shall have solid forged steel main arms (and forged forearms for parallel arm closers).

5. Closer arms (and metal covers when specified) shall have a powder coating finish.

6. Provide drop, mounting plates, where required.

7. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel or track type arms.

8. All door closers shall be adjusted by the installer in accordance with the manufacturer's templates and written instructions. Closers with parallel arms shall have back-check features adjusted prior to installation.

9. Closers shall conform to all applicable code requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.

10. Door closers meeting this specification are as follows:

	LCN	Sargent
Exterior	4111S-CUSH	281 – CPS
	4111S-H-CUSH	281 – CPSH
Interior	4011	281- 0
	4111	281 – P10
	4040SE	2407 Series
	4000T	281 – OT x spec. TEMP.
	4310ME-SF	2980
	4040SE-DE	2477

E. EXIT DEVICES:

1. Shall be Von Duprin or Sargent as follows:

Function	Von Duprin	Sargent
A	CD99NL-OP	16-8804
B	CD99EO	16-8810
C	99L	8813ET
D	99L-BE	8815ET
E	99NL-F	12-8804
F	99L-F	12-8813ET
G	99L-F-BE	12-8815ET
H	9927EO	8710
I	9927L	8713ET
J	9927L-BE	8715ET
K	CD9927EO x LBR	16-PP/PR8710
L	9927L x LBR	PP/PR8713ET
M	9927L-BE x LBR	PP/PR8715ET
N	CD99271F	CD8710 x 306
O	9927L-F	12-8713ET
P	9927L-F-BE	12-8715ET
Q	9927EO-F x LBR	12-PP/PR8710
R	9927L-F x LBR	12-PP/PR8713ET
S	9927L-F-BE x LBR	12PP/PR8715ET
T	EL9927TP	56-8710 x 306
U	EL99L-F	56-12 8813 ETL
V	EL99NL-OP	56-8804

NOTE: Lever design shall match lock trim

F. HEAVY DUTY LEVER HANDLE CYLINDRICAL LOCKS:

1. Locksets for this project shall be heavy duty cylindrical key-in-lever handle type locksets.

2. Locksets shall be 2 ¾" backset with ½" throw latchbolt, with deadlocking latch, and a cylindrical housing of steel with a zinc dichromate finish.

3. Locksets shall be fastened by thru-bolts, thru the 3 ½" diameter inside rose back plate into the threaded studs in the outside rose back plate. Thru-bolts shall be placed in separate bolt holes, thru the door and outside the cylindrical case at 180 deg. from each other.

4. The inside and outside rose scalps shall be 3 ½"diameter wrought brass or bronze. When assembled, all thru-bolts in the face of the door shall be concealed from view. The lever handles shall be solid cast in the same finish as the rose.

5. Cylinders to be small format interchangeable core Schlage Everest "B" Family Restricted keyway cores and is also completely compatible with Best.

6. The ½' throw latchbolt shall be listed and approved for use by Underwriters Laboratories.

7. Strikes shall be curved lip ANSI A115.2 4 7/8" x 1 ¼" wrought brass or bronze.

8. The following locksets shall be considered acceptable for this project:

Schlage	"ND" Series	RHO Design	No exception

9. Include all permanent and construction cores.

10. Lock functions as indicated in the hardware schedule shall be as follows:

Function	Schlage	
A(Storeroom)	80	
B(Storeroom)	80	(Knurled Outside Lever)
C(Office)	50	
D(Passage)	10	
E(Vestibule)	60	
F(Classroom)	70	
G(Spec Classroom)	71	
H(Privacy)	40	
I(Apt Entrance)	53	
J(Elec)	96PDEU	(Fail Secure w/RX Switch)

G. DEADLOCKS:

Where called for in the hardware sets provide deadlocks as follows:

Function	Schlage
I (Classroom)	63

H. PUSH PLATES, DOOR PULLS, PUSH/PULL BARS:

1. Shall be as manufactured by Rockwood, Burns or Ives.

   a. Push plates shall be 4" x 16" x .050 thickness unless otherwise listed in hardware sets.

Rockwood	70 Series
Burns	50 Series
Quality	40 Series

   b. Door pulls shall be 1" x 10"

   Type A

Rockwood	BF111
Burns	BF26C
Quality	BF163-10"

   c. Push/pull bars

   Type A (Wide Stile Doors)

Rockwood	BF11147 x T1006 Mounting
Burns	BF26C x 442 x Sim. Mounting as Above
Quality	BF 482 x Sim. Mounting as Above

I. KICK PLATES, ARMOR PLATES, MOP PLATES:

1. Kick plates shall be 8 in. high. Armor plates shall be 34 in. high. Mop plates shall be 4 in. high. All plates shall be 2 in. less the width of door. Plates shall be .050 thickness, bevel 4 edges, screws shall be oval head counter-sunk.

J. STOPS

1. Shall be furnished at all doors. Wherever and opened door or any item of hardware thereon strikes a wall, at 90 degrees. Provide wall bumpers, unless otherwise indicated in hardware sets.

2. Where wall bumpers cannot be effectively used, a floor stop shall be furnished and installed.

3. Provide roller bumpers for each door where two doors interfere with each other in swinging.

Manufacturer	Wall Bumpers	Floor Stops	Roller Bumpers
Rockwood	409	440, 442	456
Ives	407 ½	436B, 438B	470 Series
Glynn Johnson	WB 50XT	FB13, FB14	RB-3

4. Where overhead stops are listed they shall be the surface mounted type as follows:

Manufacturer	Series
Glynn Johnson	GJ450
Sargent	1540
ABH	4400

K. THRESHOLDS, WEATHERSTRIP, SEAL:

1. Thresholds shall be as detailed and furnished on all doors where shown on drawings. Thresholds shall be aluminum unless otherwise indicated. Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants".

2. Weatherstripping shall be furnished on all exterior doors unless otherwise indicated.

Product	Pemko	Reese	NGP
Threshold	as detailed		
Brush Seal	45062AP	970	A626A
Auto. Door Bottom	430CR	330	420
Door Sweep	345AV	353	101AV
Set Astragals	351C x 351CP	95 x 95P	140 x 140P
Astragal	357SP	183S	139SP
Rain Drip	346C	R210A	16A

L. ACCESS CONTROL SYSTEM:

The access control system shall be WAPAC for windows manufactured by Synergistics, Inc. of Natick, MA, no exception. The controller shall be a CC1065NW located in Data Room 010. The readers shall be mag stripe insertion type, appropriate for the particular application and compatible with the University's existing cards.

M. POWER SUPPLY:

Provide Sargent 3540 power supply.

N. LOW-ENERGY OPERATOR:

Provide Horton 4100LE Low Energy Operator. Push Button Switches to be Wireless Type Radio Control Unit. Provide MC-25 Interface Switch for All Operators with Card Access Control.

PART 3—EXECUTION

3.01. INSPECTION

1. It shall be the general contractors responsibility to inspect all doors openings and doors to determine that each door and door frame has been properly prepared for the required hardware. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

3.02 PREPARATION

1. All doors and frames, requiring field preparation for finish hardware, shall be carefully mortised, drilled for pilot holes, or tapped for machine screws for all items of finish hardware in accordance with the manufacturers templates and instructions.

3.03 INSTALLATION/ADJUSTMENT/LOCATION

1. All materials shall be installed in a workmanlike manner following the manufacture's recommended instructions.

2. Exit Devices shall be carefully installed so as to permit friction free operation of crossbar, touch bar, lever. Latching mechanism shall also operate freely without friction or binding.

3. Door Closers shall be installed in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening indicated on the hardware schedule. Arm position shall be shown on the instruction sheets and required by the finish hardware schedule.

4. The adjustments for all door closers shall be the installer's responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and the latching speed valves, shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the correct delayed action cycle or hydraulic back check valve shall also be adjusted so as the opening cycle. All valves must be properly adjusted at the time of installation. Each door closer has adjustable spring power capable of being adjusted, in the field from size 2 thru 6. It shall be the installers' responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closed.

5. Installation of all other hardware, including locksets, push-pull latches, overhead holders, door stops, plates and other items, shall be carefully coordinated with the hardware schedule and the manufacturer's instruction sheets.

6. Locations for finish hardware shall be in accordance with dimensions listed in the pamphlet "Recommended locations for Builders' Hardware" published by the Door and Hardware Institute.

3.04 FIELD QUALITY CONTROL

1. Upon completion of the installation of the finish hardware, it shall be the responsibility of the finish hardware supplier to visit the project and to examine the hardware for each door on which he has provided hardware and to verify that all hardware is in proper working order. Should he find items of hardware not operating problem he should make a report, in writing, to the general contractor, advising him of the problem and the measures required to correct the problem.

3.05 PROTECTION

1. All exposed portions of finish hardware shall be carefully protected, by use of cloth, adhesive backed paper or other materials, immediately after installation of the hardware item on the door. The finish shall remain protected until completion of the project. Prior to acceptance of the project by the Architect and owner, the general contractor shall remove the protective material exposing the finish hardware.

3.06 CLEANING

1. It shall be the responsibility of the general contractor to clean all items of finish hardware and to remove any remaining pieces of protective materials and labels.

3.07 INSTRUCTIONS AND TOOLS

1. It shall be the responsibility of the finish hardware supplier to provide installation and repair manuals and adjusting tools, wrenches, etc... for the following operating products.

   a. Locksets (all types)
   b. Exit Devices (all types)
   c. Door Closers

3.08 HARDWARE SETS

1. Each Hardware Set listed below represents the complete hardware requirements for one opening. (Single Door or Pair of Doors). Furnish the quantities required for each set for the work.

HW 1

Doors #001A, 023B, 012A, 012B, 105A, 105B, 103A, 210A, 213A, 301A, 316A
Each Leaf Shall Have: Hinges, Exit Device (Function F), Door Closer, Kick Plate, Door Stop, Silencers

HW 2

Doors #105C, 103B
Each Leaf Shall Have: (1) Electric Hinge, Hinges, Exit Device (Function U), Card Reader, Door Closer, Kick Plate, Door Stop, Silencers

HW 3

Doors #017A, 018A
Each Leaf Shall Have: Hinges, Exit Device (Function E), Door Closer, Pull, Door Stop, Silencers

HW 4

Doors #015A, 236A, 402A, 127A, 129A, 206A
Each Leaf Shall Have: Hinges, Lockset (Function B), Door Closer, Door Stop, Silencers

HW 5

Doors #011A, 010A, 002AX, 006AX, 238A, 318A, 143A, 240A
Each Leaf Shall Have: Hinges, Lockset (Function A), Door Closer, Door Stop, Silencers

HW 6

Doors #013A
Each Leaf Shall Have: Hinges, Lockset (Function A), Flush Bolts, Door Closer, Door Stops, Silencers

HW 7

Doors #128A
Each Leaf Shall Have: Hinges, Exit Device (Function A), Pull, Door Closer (Cush N Stop Arm), Threshold, Weatherstrip, Door Bottom, Silencers

HW 8

Doors #109B
Each Leaf to Have: (1) Electric Hinge, Hinges, Exit Device (Function V), Pull, Auto Operator, Threshold, Weatherstrip, Door Bottom, Silencers, Card Reader

HW 9

Doors #108A
Each Leaf Shall Have: (1) Electric Hinge, Hinges, Exit Device (Function T, H), Auto Operator, Door Closer (Cush N Stop Arm), Offset Pulls, Card Reader
(Balance of Hardware by Aluminum Door Supplier)

HW 10

Doors #108B
Each Leaf Shall Have: Hinges, Push/Pull Bars, Door Closer (Cush N Stop Arm), Door Stops
(Balance of Hardware by Aluminum Door Supplier)

HW 11

Doors #101A
Each Leaf Shall Have: Hinges, Exit Devices (Function N, H) Door Closers (Cush N Stop Arm), Auto Operator, Offset Pulls
(Balance of Hardware by Aluminum Door Supplier)

HW 12

Doors #101B
Each Leaf Shall Have: Hinges, Push/Pull Bars, Door Closers, Door Stops
(Balance of Hardware by Aluminum Door Supplier)

HW 13

Door #126A
Each Leaf Shall Have: (1) Electric Hinge, Hinges, Lockset (Function J), Flush Bolts, Door Closer (Cush N Stop Arm), Card Reader, Threshold, Weatherstrip, Door Bottom, Z Astragal, Silencers

HW 14

Doors #300A, 300B, 300C, 009A
Each Leaf Shall Have: (1) Electric Hinge, Hinges, Lockset (Function J), Door Closer, Kick Plate, Card Reader, Door Stop, Silencers

HW 15

Doors #124A, 125A, 211A, 212A
Each Leaf Shall Have: Hinges, Push Plate, Pull, Door Closer, Kick Plate, Door Stop, Silencers

HW 16

Doors #114A, 132A, 130A, 142A, 121A, 133B, 230A, 344A, 307A, 055A
Each Leaf Shall Have: Hinges, Lockset (Function F), Door Stop, Silencers

HW 17

Doors #111A, 111B, 304A, 317A
Each Leaf Shall Have: Hinges, Lockset (Function D), Door Stop, Silencers

HW 18

Doors #116A, 118A, 117A, 120A, 123A, 207A, 209A, 214A, 215A, 216A, 217A, 217B, 218A, 219A, 220A, 221A, 222A, 223A, 224A, 204A, 225A, 226A, 228A, 231A, 232A, 233A, 234A, 235A, 237A, 239A, 242A, 243A, 303B, 305A, 308A, 310A, 312A, 314A, 315A, 319A, 320A, 321A, 322A, 324A, 325A, 326A, 343A, 336A, 337A, 338A, 339A
Each Leaf Shall Have: Hinges, Lockset (Function C), Door Stop, Silencers

HW 19

Doors #311A, 313A
Each Leaf Shall Have: Hinges, Lockset (Function H), Door Stop, Silencers

HW 20

Doors #115A, 110A, 203B
Each Leaf Shall Have: Hinges, Lockset (Function F), Door Closer, Kick Plate, Door Stop, Silencers

HW 21

Doors #109A
Each Leaf Shall Have: Hinges, Exit Device (Function I), Door Closers, Kick Plates, Door Stops, Silencers

HW 22

Doors #203A, 205A
Each Leaf Shall Have: Hinges, Lockset (Function F), Flush Bolts, Door Closer, Kick Plates, Door Stops, Silencers

HW 23

Doors #140A
Each Leaf Shall Have: Card Reader Both Inside Elevator and Outside

HW 24

Doors #019A, 020A
Each Leaf Shall Have: Card Reader Outside Elevator

HW 25

Doors #141A
Each Leaf Shall Have: Card Reader Inside Elevator

ALTERNATE #1

HW A

Doors #021A, 054A, 002B, 053B, 053A
Each Leaf Shall Have: Hinges, Push Plate, Pull, Door Closer, Kick Plate, Door Stop, Silencers

HW B

Doors #008A, 050A, 051A, 034A
Each Leaf Shall Have: Hinges, Lockset (Function C), Door Stop, Silencers

HW C

Doors #002A
Each Leaf Shall Have: Exit Device (Function C)
(Change Lockset from Base Price to Exit Device)

HW D

Doors #006A
Each Leaf Shall Have: Electric Hinge, Lockset (Function J)
(Balance of Hardware Under Base Bid)

HW E

Doors #003A
Each Leaf Shall Have: Electric Hinge, Hinges, Lockset (Function J), Flush Bolts, Door Closer, Kick Plates, Door Stop, Silencers

HW F

Doors #004A, 022A, 035A, 033A, 023A, 046A
Each Leaf Shall Have: Hinges, Lockset (Function F), Flush Bolts, Door Closer, Kick Plates, Door Stops, Silencers

HW G

Doors #040A, 041A, 043A, 045A, 047A, 048A, 025A, 031A
Each Leaf Shall Have: Electric Hinge, Hinges, Lockset (Function J), Door Closer, Kick Plate, Door Stop, Seals, Auto Door Bottom, Silencers, Card Reader

HW H

Doors #042A, 044A
Each Leaf Shall Have: Hinges, Lockset (Function F), Door Closer, Kick Plate, Door Stop, Seals, Auto Door Bottom, Silencers

HW I

Doors #007A, 049A, 024A
Each Leaf Shall Have: Hinges, Lockset (Function A), Door Stop, Silencers

HW J

Doors #026A, 027A, 029A, 030A
Each Leaf Shall Have: All Hardware by Door Supplier

HW K

Doors #032A, 038A
Each Leaf Shall Have: Cylinder to Suit Lock Type

END OF SECTION

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed entrances.
4. Interior borrowed lites.
5. Storefront framing.

B. Related Section include the following:
1. Division 1 Section "Sustainable Design Requirements".

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   a. Specified Design Wind Loads: As indicated, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures" : Section 6.0 "Wind Loads."

   b. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.

      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.
      3) For laminated-glass lites.

   c. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.

3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:

   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
   b. Solar Heat Gain Coefficient: NFRC 200.
   c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

C. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.

1. Each color of tinted float glass.
2. Coated vision glass.
3. Ceramic-coated spandrel glass.
4. Wired glass.
5. Insulating glass for each designation indicated.
6. For each color (except black) of exposed glazing sealant indicated.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

F. Qualification Data: For installers.

G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

H. Product Test Reports: For each of the following types of glazing products:

1. Tinted float glass.
2. Coated float glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing gaskets.

I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass laminated glass and insulating glass.

C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
2. Glass Testing Agency Qualifications: An independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.

G. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

H. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

I. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.

K. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. 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.

2.2 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

a. Available Products:

1) AFG Industries Inc.; Krystal Klear.
2) Pilkington Building Products North America; Optiwhite.
3) PPG Industries, Inc.; Starphire.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites

and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.

3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

C. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent flat glass), Quality-Q3, and complying with other requirements specified.

1. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048.

D. Pyrolytic-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide coating applied by pyrolytic deposition process during initial manufacture, and complying with other requirements specified.

E. Coated Spandrel Float Glass: Float glass complying with other requirements specified and with the following:

F. Wired Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.

G. Laminated Glass: ASTM C 1172, and complying with other requirements specified and with the following:

1. Interlayer: Polyvinyl butyral or cured resin of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

   a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
   b. For cured-resin interlayers, laminate lites with laminated-glass manufacturer's standard cast-in-place and cured-transparent-resin interlayer.

2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

H. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required by code.

3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:

   a. Manufacturer's standard sealants.

5. Spacer Specifications: Manufacturer's standard spacer material and construction.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral-Curing Silicone Glazing Sealants:

a. Available Products:

1) Dow Corning Corporation; 790.
2) GE Silicones; SilPruf LM SCS2700.
3) Tremco; Spectrem 1 (Basic).
4) GE Silicones; SilPruf SCS2000.
5) Pecora Corporation; 864.
6) Pecora Corporation; 890.
7) Polymeric Systems Inc.; PSI-641.
8) Sonneborn, Div. of ChemRex, Inc.; Omniseal.
9) Tremco; Spectrem 3.

b. Type and Grade: S (single component) and NS (nonsag).
c. Class: 50.
d. Use Related to Exposure: NT (nontraffic).

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.8 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements.

1. Thickness: 6.0 mm.
2. Self-Cleaning, Low-Maintenance Coating: Pyrolytic coating on first surface.
3. Location: Interior barrowed lights unless noted otherwise.

2.9 MONOLITHIC CERAMIC-COATED SPANDREL-GLASS UNITS

A. Ceramic-Coated Spandrel-Glass Units:

1. Class 2 (tinted) float glass.

2. Kind FT (fully tempered).
3. Thickness: 6.0 mm.
4. Ceramic Coating Color: As selected by Architect from manufacturer's full range.
5. Coating Location: Second surface.

2.10 MONOLITHIC WIRED-GLASS UNITS

A. Polished Wired-Glass Units: Form 1 (wired glass, polished both sides), Quality-Q6, Mesh 2 (M2) (Square), 6.0 mm thick.

1. Available Manufacturers:

a. Asahi/AMA Glass Corp.; affiliated with AFG Industries, Inc.
b. Central Glass Co., Ltd.; distributed by Northwestern Industries Inc.
c. Pilkington Sales (North America) Ltd.

2.11 INSULATING-GLASS UNITS

A. Clear Insulating-Glass Units:

1. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
2. Outdoor Lite: Class 1 (clear) float glass.
   a. Annealed or Kind FT (fully tempered) where required by code.

3. Indoor Lite: Class 1 (clear) float glass.

   a. Annealed Kind FT (fully tempered) where required by code.

B. Passive Solar Low-E Insulating-Glass Units:

1. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
2. Outdoor Lite: Class 1 (clear) float glass.
   a. Annealed or Kind FT (fully tempered) where required by code.

3. Indoor Lite: Class 1 (clear) float glass.

   a. Annealed or Kind FT (fully tempered) where required by code.
4. Low-E Coating or Film: Pyrolytic or sputtered on second or third surface or low-e-coated film suspended in the interspace.
5. Silk-Screened Coating: Ceramic enamel on second surface.

C. Ceramic-Coated Spandrel Insulating-Glass Units:

1. Construction: Provide units that comply with requirements specified for insulating-glass units designated except for indoor lite.
2. Indoor Lite: Ceramic-coated spandrel glass.

   a. Kind FT (fully tempered).
   b. Ceramic Coating Location: Fourth surface.
   c. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and

glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 089000 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fixed, formed-metal louvers.

B. See Division 23 Sections for louvers that are a part of mechanical equipment.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward, without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

C. Thermal Movements: Provide louvers that allow for thermal movements resulting from a temperature change (range) of 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces, by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

D. Air-Performance, Water-Penetration, and Wind-Driven Rain Ratings: As demonstrated by testing manufacturer's stock units according to AMCA 500-L.

1.3 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

1. Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.
2. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples: For each type of finish.

D. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Louvers:

a. Airline Products Co.
b. Airolite Company (The).
c. American Warming and Ventilating, Inc.
d. Arrow United Industries.
e. Carnes Company, Inc.
f. Cesco Products.
g. Construction Specialties, Inc.
h. Dowco Products Group; Safe-Air of Illinois, Inc.
i. Greenheck.
j. Industrial Louvers, Inc.
k. Louvers & Dampers, Inc.
l. Metal Form Manufacturing Company, Inc.
m. NCA Manufacturing, Inc.
n. Nystrom Building Products.
o. Reliable Products; Hart & Cooley, Inc.
p. Ruskin Company; Tomkins PLC.
q. Vent Products Company, Inc.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.

E. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

A. Fabricate frames to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to louver blades with fillet welds concealed from view.

C. Join frame members to each other and to louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view.

2.4 FIXED, FORMED-METAL LOUVERS

A. Horizontal, Drainable-Blade Louver:

1. Frame and Blade Material and Nominal Thickness: Galvanized steel sheet, not less than 0.052 inch (1.3 mm) for frames and 0.040 inch (1.0 mm) for blades.
2. Frame and Blade Material and Nominal Thickness: Stainless-steel sheet, but not less than 0.050 inch (1.3 mm).
3. Performance Requirements:

a. Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) for 48-inch- (1.2-m-) wide by 48-inch- (1.2-m-) high louver.
b. Point of Beginning Water Penetration: Not less than 800 fpm (4.1 m/s).

2.5 LOUVER SCREENS

A. General: Provide screen at interior face of each exterior louver.

B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.

C. Louver Screening:

1. Bird Screening: Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm) wire.

2.6 FINISHES

A. Galvanized Steel, Powder-Coated Finish: Immediately after cleaning and pretreating, apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).

1. Color and Gloss: As selected from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION 089000

SECTION 092600

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.02 SUMMARY

A. This Section includes the following:
1. Interior gypsum wallboard.
2. Exterior gypsum board panels for ceilings and soffits.
3. Tile backing panels.
4. Gypsum board shaft wall assemblies.
5. Acoustical insulation and sealants.
6. Non-load-bearing steel framing.
7. Firestopping.

B. Related Sections include the following:

1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing and gypsum sheathing..
2. Division 1 Section "Sustainable Design Requirements"
3. Division 7 Section "Fire-Resistive Joint Systems" for fire-resistive joints not covered by work of this Section.
4. Division 7 Section "Joint Sealants" for sealants not covered by work of this Section.
5. Division 9 painting Sections for coordination/inspection requirements with painting contractor and primers applied to gypsum board surfaces.

1.03 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
   1. Firestopping: For each joint condition where fire-rated walls and partitions interface other walls, floors, structural members or other building structure, provide UL firestop system description and drawing. Show each kind of construction condition and relationships to adjoining construction. Indicate which firestop materials will be used where and thickness for different hourly ratings. Include UL firestop design designation that evidences compliance with requirements for each condition.

D. LEED-Required Submittals per Division 1 Section 018113.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory," GA-600, "Fire Resistance Design Manual," or in listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Deflection Firestop Track: Top runner indicated in fire-resistance-rated assemblies shall be labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Source Limitations for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single source from a single manufacturer.

C. Source Limitations for Panel Products: Obtain each type of gypsum board and other panel products from a single source from a single manufacturer.

D. Source Limitations for Finishing Materials: Obtain finishing materials from either manufacturer supplying gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

E. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockup using room designated by Architect to demonstrate aesthetic effects and qualities of materials and execution.
   1. Install mockups for surfaces indicated to receive nontextured paint finishes.
   2. Simulate finished lighting conditions for review of mockups.
   3. Mockup will be painted under Division 9 Section "Painting" to provide finished condition for viewing.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to on leveled supports off floor or slab prevent sagging.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F for 48 hours before application and continuously after until dry. Do not exceed 95 deg F when using temporary heat sources.

E. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM C 754 for conditions indicated.
1. Manufacturers:
a. Dale Industries, Inc. - Dale/Incor.

b. Dietrich Industries, Inc.
c. MarinoWare; Division of Ware Industries.
d. National Gypsum Company.
e. Unimast, Inc.

B. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, not less than 0.1620-inch- diameter (8-gage) wire, or double strand of not less than 0.099-inch- diameter (12-gage) wire.

C. Hanger Attachments to Concrete: As follows:
1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

D. Hangers: As follows:
1. Wire Hangers: ASTM A 641, Class 1 zinc coating, soft temper, 0.162-inch (8-gage) diameter.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with ASTM A 653, G40, hot-dip galvanized zinc coating.
1. Depth: As indicated.

F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653, G40, hot-dip galvanized zinc coating.
1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
a. Minimum Base Metal Thickness: 0.0312 inch (22 gage).

G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock, heavy-duty.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
b. Chicago Metallic Corporation; Drywall Furring 640 System.
c. USG Interiors, Inc.; Drywall Suspension System.
d. Provide comparable system where fire-rated ceilings are indicated.

2.03 STEEL PARTITION AND SOFFIT FRAMING

A. Manufacturers:
1. Dale Industries, Inc. - Dale/Incor.
2. Dietrich Industries, Inc.
3. MarinoWare; Division of Ware Industries.
4. National Gypsum Company.
5. Unimast, Inc.

B. Components, General: As follows:
1. Comply with ASTM C 754 for conditions indicated.
2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G40, hot-dip galvanized zinc coating.

C. Steel Studs and Runners: ASTM C 645.

1. Minimum Base Metal Thickness: 0.027 inch (22gage)minimum, unless otherwise indicated.
   a. Provide studs with 0.0329 inch (20-gage) minimum thickness at the following locations:
      1) For 6 inch or greater framing.
      2) Jamb studs for door openings.
      3) At locations to receive abuse-resistant board.
      4) Where indicated.
   b. Provide studs with recognizable identifier on surface so different gages installed in walls can be easily identified.
2. Depth: As indicated.
3. Maximum Allowable Deflection: Increase metal thickness where required to meet the following:
   a. Maximum Allowable Deflection for Drywall Assemblies: L/240 calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.
   b. Maximum Allowable Deflection for Drywall Assemblies Receiving Tile: L/360 calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.

D. Deep-Leg Deflection Track: ASTM C 645 top runner with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.

E. Firestop Deflection Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs. Provide deflection track with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.
   1. Product: Subject to compliance with requirements, provide the following:
      a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base Metal Thickness: 0.0598 inch (16-gage), unless indicated otherwise.

G. Cold-Rolled Channel Bridging: 0.0538-inch (16-gage) minimum bare steel thickness, with minimum 1/2-inch- wide flange.
   1. Depth: 1-1/2 inches.
   2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.0312 inch (20 gage).
   2. Depth: 7/8 inch, unless otherwise indicated.

I. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, 20 gauge, .0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

J. Deflection Brackets:
   1. Construction: Slotted galvanized steel angle with step bushing to prevent over tightening of fasteners.
   2. Vertical Deflection: 1-1/2 inch total travel.

3. Product: VertiClip; Signature Industries, (919) 844-0789.
   a. Series: SL, SDL, SLB, and SLS as required by attachment condition.

K. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.

2.04 INTERIOR GYPSUM WALLBOARD

A. Manufacturers:
1. G-P Gypsum Corporation.
2. National Gypsum Company.
3. United States Gypsum Company.

B. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

C. Gypsum Wallboard (GPDW & GWB): ASTM C 36.
1. Type X:
   a. Thickness: 5/8 inch.
   b. Long Edges: Tapered.
   c. Location: All locations, except as otherwise noted.

D. Moisture-Resistant Gypsum Board (MR GPDW & MR GWB): ASTM C 630.
1. Type X:
   a. Thickness: 5/8 inch, unless otherwise indicated.
   b. Long Edges: Tapered.
   c. Location: All toilet rooms, except as otherwise noted, and other locations where indicated.

E. Glass-Mat, Water-Resistant Tile Backing Board: ASTM C 1178.
1. Product: Dens-Shield Tile Backer; G-P Gypsum Corp.
2. Core: 5/8 inch, Type X.
3. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
4. Locations: Behind tile in tiled showers.

F. Impact- and Penetration-Resistant Gypsum Wallboard: ASTM C 630 and C 1396, Type X; gypsum core wall panel with additives to enhance fire- and mold/mildew-resistance of core; surfaced with abrasion-, moisture-, and mold/mildew-resistant paper on the front, back and long edges; with a fiberglass mesh embedded in the board to enhance impact/penetration resistance.
1. Products:
   a. Hi-Impact Brand XP Fire-Shield Wallboard; National Gypsum Company.
   b. Fiberock Brand VHI Abuse-Resistant Gypsum Fiber Interior Panels; United States Gypsum Co.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered.
4. Surface Abrasion Resistance: ASTM D 4977 (Modified), not greater than 0.284 inch depth when tested at 50 cycles.
5. Indentation Resistance: ASTM D 5420, not greater than 0.16 inch depth when tested at an impact load of 72 in.-lbs.

6. Impact/Penetration Resistance: ASTM E 695, not less than 480 ft.-lbs required to penetrate when using a weight of 60 lbs.
7. Mold/Mildew Resistance: ASTM D 3273, not less than 8.
8. Location: Where indicated.

2.05 EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Exterior Gypsum Soffit Board: ASTM C 931, with manufacturer's standard edges.
1. Core: Manufacturers standard.

2.06 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. General: Provide assemblies constructed of proprietary gypsum liner panels inserted between steel tracks at each end of studs; with specially shaped steel studs engaged in tracks and fitted between gypsum liner panels; and with gypsum board on finished side or sides applied to studs in the number of layers, thicknesses and arrangement indicated.

B. Partition Framing: ASTM C 645, manufacturer's standard stud profile, hot-dip galvanzied, for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
1. Depth: As indicated.
2. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches, in depth matching studs.
3. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated, but not less than 0.0359 inch (20 gage).
4. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
   a. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.

C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.

D. Cavity Insulation: Provide sound-attenuation blankets in cavity formed by studs between shaft-wall liner panels and room-side finish.

E. Finishes:
1. Room-Side: As indicated.
2. Shaft Side: Provide only where finish is indicated on shaft side as well as room side, otherwise leave liner panel exposed.

2.07 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047, galvanized steel.
   1. Shapes:
      a. Cornerbead: 1-1/4 inch x 1-1/4 inch external corner with 1/8-inch nose bead. Use at outside corners, unless otherwise indicated.
      b. LC-Bead (Casing): J-shaped casing with 1/16-inch nose bead ground, not less than 30 gage; exposed long flange receives joint compound; use at exposed panel edges.
      c. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound; use at exposed panel edges and where indicated.
      e. Expansion (Control) Joint: One-piece control joint formed with V-shaped slot and removable strip covering slot opening.

B. Exterior Trim: ASTM C 1047.
   1. Material: Hot-dip galvanized steel sheet.
   2. Shapes:
      a. Cornerbead: Use at outside corners.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
      c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. Use where indicated.

2.08 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper reinforcing tape. Fiberglass tape not permitted.
   2. Exterior Gypsum Soffit Board: Paper reinforcing tape. Fiberglass tape not permitted.
   3. Glass-Mat, Water-Resistant Tile Backing Panels: As recommended by panel manufacturer.

C. Setting-Type Joint Compound: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
   1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.

D. Drying-Type Joint Compound: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   1. Ready-Mixed Formulation: Factory-mixed product.

E. Type of Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound or drying-type, all-purpose compound.

3. Fill Coat: For second coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.

F. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.

G. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by manufacturer.

2.09 ACOUSTICAL SEALANT

A. Products:
1. Acoustical Sealant for Exposed and Concealed Joints:
   a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
   b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
2. Acoustical Sealant for Concealed Joints:
   a. Ohio Sealants, Inc.; Pro-Series SC-175 Acoustical Sound Sealant.
   b. Pecora Corp.; AIS-919.
   c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.10 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Fastening gypsum board to steel members: Type S bugle head.

C. Sound Attenuation Blankets (Acoustical Insulation): ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Manufacturers:
   a. Certainteed.
   b. Owens Corning.
   c. Johns Manville.

D. Insulation Support Anchors: Insul-Fast 25 gauge galvanized continuous metal support strip with pre-punched tabs at 8 inches on center.

E. Polyethylene Vapor Retarder: As specified in Division 7 Section "Building Insulation."

F. Firestopping: See Division 7 Section "Through-Penetration Firestop Systems." Provide firestopping where fire rated gypsum board assemblies butt masonry, steel deck, joists, beams, and structural members as part of the gypsum board assembly work. Penetrations through fire-resistance-rated walls and partitions by Division 15 and 16 work, including both empty openings and openings containing cables, pipes, ducts and conduits are specified as part of the Division 15 and 16 work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Post-Installation Inspection: Inspect walls for dents and imperfections, with Installer and painter present, prior to painting. Inspect wall again after primer and first coat of paint applied, with Installer and painter present. Installer shall touch-up as follows:
1. Touch-up visible gypsum board imperfections before priming of walls.
2. Touch-up imperfections found in field of boards and joints made visible from painting after first finish coat applied.
3. Joint compound touch-up shall be primed and pained before final coat is applied and viewed for acceptability.

3.02 PREPARATION

A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

3.03 INSTALLING STEEL FRAMING, GENERAL

A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board

manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
   1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
   2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
      a. Allow for 3/4-inch deflection at floors and 1-1/2 inches at roofs.
      b. Install deflection track top runner or deflection brackets to attain lateral support and avoid axial loading.
      c. Install deflection firestop track top runner at fire-resistance-rated assemblies.
         1) Attach jamb studs at openings to tracks using manufacturer's standard stud clip.

D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.04 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Suspend ceiling hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
   3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
   4. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   5. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet measured lengthwise on each member and transversely between parallel members.

C. Sway-brace suspended steel framing with hangers used for support.

D. For exterior soffits, install cross bracing and framing to resist wind uplift.

E. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.

F. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
   1. Hangers: 48 inches o.c.

2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

G. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
1. Fire-Rated Ceilings:
   a. Butt Joints: Provide extra cross tees spaced 8 inches or less on either side of butt joints.
   b. Fire Relief Notch: Provide a hanger wire installed adjacent to fire relief notch.

3.05 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs 1/2 inch short of full height to provide perimeter relief. Do not fasten studs to top track to allow independent movement of studs and track.
2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.

D. Install steel studs and furring at the following spacings:
1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
2. Multilayer Construction: 16 inches o.c., unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
1. Attach both flanges to floor runner track with screws.

F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
1. Install two studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint.
3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above, even when partitions are not full height. Provide diagonal bracing at tall partitions to stop deflection and vibration of studs when doors are slammed shut.
4. Extend jamb studs one-piece full height.

G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

H. Frame chase walls and double stud party walls to indicated widths. Provide 2-1/2 inch steel stud cross bracing, spaced maximum 48 inches on center.

3.06 INSTALLATION OF ACOUSTICAL INSULATION

A. Install acoustical insulation at locations indicated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

B. Install a single layer of insulation of required thickness to fill the full depth of cavity, unless otherwise shown. Where cavity requires insulation that is thicker than standard size, install next larger size and compress into cavity.

C. Hold batt insulation in place with insulation support anchors located at 5 feet on center, full height of wall, starting at the top of each stud space.

D. Stuff glass fiber loose fill insulation into miscellaneous voids and cavity spaces. Fill box headers, and voids while framing is being erected that will be inaccessible for installation later. Compact to approximately 40 percent of normal maximum volume (to a density of approximately 2:5 pcf).

3.07 INSTALLATION OF GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 for installing steel framing.

B. Do not bridge building expansion joints with shaft-wall assemblies; frame both sides of joints with furring and other support.

C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

D. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators and similar items.
   1. See Division 7 Section "Through-Penetration Firestop Systems" for treatment of space around perimeter of penetration.

E. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.

F. Install control joints to maintain fire-resistance rating of assemblies.

G. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain

an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

3.08 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216, except as specified otherwise.

B. Install acoustical insulation, where indicated, before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

G. Attach gypsum panels to framing provided at openings and cutouts.

H. Form control and expansion joints with space between edges of adjoining gypsum panels.
   1. Where control joints are not shown, provide control joints at a maximum spacing of 30 feet; review proposed locations with Architect prior to installation.

I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant. Caulk smoke partitions to prevent the passage of smoke.

J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with casing bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
   1. Space screws a maximum of 12 inches o.c. for vertical applications.

L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

M. Remove screws that do not hit studs, supports, or blocking.

3.09 PANEL APPLICATION METHODS

A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
a. Stagger abutting end joints not less than one framing member in alternate courses of board.

B. Multilayer Application on Partitions/Walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

C. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

D. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

E. Exterior Soffits and Ceilings: Apply exterior gypsum soffit board panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

F. Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at showers, and where indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

3.10 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Install corner bead at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
3. Install U-bead where indicated.

D. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.11 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, flanges of corner bead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas using setting-type joint compound.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Apply joint tape over gypsum board joints and to flanges of trim accessories as recommended by trim accessory manufacturer.

E. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
   1. Level 1: At ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
   2. Level 2: Where panels are substrate for tile and where indicated.
   3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
   4. Level 5: **At Hall 100 and other places indicated.**

F. Glass-Mat, Water-Resistant Tile Backing Panels: Finish board forming base for ceramic tile to comply with ASTM C 840 and according to manufacturer's written instructions for treatment of joints behind tile.

G. Where Level 1 gypsum board finish is indicated, embed tape in joint compound. Surface shall be free of excess joint compound.

H. Where Level 2 gypsum board finish is indicated, fill fastener heads, embed tape in joint compound and apply thin coat of joint compound over all joints and interior angles.

I. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
   1. At tapered edge joints, draw compound down to a level plane, leaving a monolithic surface that is flush with the paper face. Finish coat shall be feathered a minimum of 8 inches beyond both sides of center of joint tape.
   2. At end-to-end butt joints, draw compound down to minimize hump created by joint tape application. Finish coat shall be feathered a minimum of 16 inches beyond both sides of center of joint tape.
   3. End product shall be a surface that appears level without telegraphing joint locations as high spots when viewed down wall after painting.
   4. Finish board to within 1/4 inch of floor, providing full support for resilient wall base without telegraphing joint.

J. Level 5: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface at Hall 100 and other places indicated.

3.12 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
   a. Installation of 80 percent of lighting fixtures, powered for operation.
   b. Installation, insulation, and leak and pressure testing of water piping systems.
   c. Installation of air-duct systems.
   d. Installation of air devices.
   e. Installation of mechanical system control-air tubing.
   f. Installation of above ceiling automatic fire suppression piping, including leak and pressure testing.
   g. Installation of ceiling support framing.

3.13 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensures gypsum board assemblies are without damage or deterioration at time of Substantial Completion.

END OF SECTION 09260

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.2 SUMMARY

A. This Section includes the following:

1. Ceramic mosaic tile.
2. Glazed wall tile.
3. Waterproof membrane for tile installations.
4. Metal edge strips installed as part of tile installations.

B. Related Sections include the following:
1. Division 03 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
2. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
3. Division 09 Section "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).

C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum 0.6.
3. Ramp Surfaces: Minimum 0.8.

1.5 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Metal edge strips in 6-inch (150-mm) lengths.

E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Qualification Data: For Installer.

H. Material Test Reports: For each tile-setting and -grouting product[**and special-purpose tile**].

I. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
1. Waterproofing.
2. Joint sealants.
3. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
3. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

A. Available Manufacturers:
1. Ragno; www.ragno.it
2. Approved architectural equal.

B. Unglazed Floor Quarry Tile: Square-edged flat tile as follows:

1. Wearing Surface: Nonabrasive, smooth.
2. Facial Dimensions: 12 by 12 inches for bathrooms, 18 by 18 inches for First Floor Hall.
3. Face: Plain.
4. For furan-grouted quarry tile, precoat with temporary protective coating.

a. Basis-of-Design Product: Ragno Metropolitan; color to be chosen by architect in either Net Bronzo or Net Platino.

2.4 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:

1. Atlas Minerals & Chemicals, Inc.
2. Boiardi Products Corporation.
3. Bonsal, W. R., Company.
4. Bostik.
5. C-Cure.
6. Custom Building Products.
7. DAP, Inc.
8. Jamo Inc.
9. LATICRETE International Inc.
10. MAPEI Corporation.
11. Southern Grouts & Mortars, Inc.
12. Summitville Tiles, Inc.
13. TEC Specialty Products Inc.

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.

a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

D. Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.

2. Ceramic tile adhesive shall have a VOC level of no more than 65 g/L.

E. Standard Sanded Cement Grout: ANSI A118.6, color as indicated.

2.5 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Available Products:

a. Dow Corning Corporation; Dow Corning 786.
b. GE Silicones; Sanitary 1700.
c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
d. Tremco, Inc.; Tremsil 600 White.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, nickel silver or stainless steel; ASTM A 666, 300 Series exposed-edge material.

C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with adhesives or thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package

show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

3.4 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

D. Grout Sealer: Apply grout sealer to[**cementitious**] grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.

C. Joint Widths: Install tile on walls with the following joint widths:
   1. Glazed Wall Tile: 1/16 inch (1.6 mm).
   2. Quarry Tile: 3/8 inch (9.5 mm).

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

   1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093000

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.2 SUMMARY

A. This Section includes acoustical tiles for ceilings and the following:

1. Acoustical panels

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light-Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. Product Data: For each type of product indicated.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of 6-inch-square Samples of each type, color, pattern, and texture.

E. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content and material safety data sheets.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical tile ceiling.

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they

will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Mechanical, electrical, and other utility service installations above the ceiling plane shall have been completed prior to the installation of the ceilings.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 ACOUSTICAL TILES, GENERAL

A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

2.3 ACOUSTICAL PANELS

A. Acoustical Panel (SAT1): Armstrong Dune Tegular Fine texture or architectural approved equal
1. Size: 24 inches x 48 inches.
2. Thickness: Not les than 3/4-inch thick.
3 Composition: Wet-formed mineral fiber.
4. Surface Finish: Factory-applied latex paint; white.
5. Surface Texture: Medium.
6. Surface Design: scored to look like 24 inch by 24 inch panel.
7. Edge: Angled tegular.
8. NRC Range: .55
9. CAC Range: 35.
10. Fire Hazard Classification: Class A, 0-25 flame spread.
11. Product: Armstrong Industries Inc.; Dune Tegular or architectural approved equal

B. Acoustical Panel (SAT2):
1. Size: 24 inches x 48 inches.
2. Thickness: Not les than 3/4-inch thick.
3 Composition: Wet-formed mineral fiber.
4. Surface Finish: Factory-applied latex paint; white.
5. Surface Texture: Medium.
6. Surface Design: scored to look like 24 inch by 24 inch panel.
7. Edge: Angled tegular.
8. NRC Range: .55
9. CAC Range: 35.
10. Fire Hazard Classification: Class A, 0-25 flame spread.
11. Product: Armstrong Industries Inc.; Armstrong Clean Room VL or architectural approved equal.
12. Anti Mold Mildew/Bacteria: BioBlock Plus.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical tile ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts,

eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.
2. Install tiles with pattern running in one direction parallel to **[long]** [**short**] axis of space.
3. Install tiles in a basket-weave pattern.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.

2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 INSTALLATION, DIRECTLY ATTACHED ACOUSTICAL TILE CEILINGS

A. Adhesive Installation: Install acoustical tile by bonding to substrate, using amount of adhesive and procedure recommended in writing by tile manufacturer and as follows:

1. Remove loose dust from backs of tiles by brushing and prime them with a thin coat of adhesive.
2. Install splines in joints between tiles; maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively.
3. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.

B. Stapled Installation: Fasten acoustical tile to substrate using a minimum of two staples per tile that are installed in flanges of tile and as follows:

1. Form double-lapped joint between tiles by securely pressing tile tongues into corresponding tile grooves.
2. Maintain level of bottom surface of tiles to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m) and not exceeding 1/4 inch (6.35 mm) cumulatively. Shim tile or correct substrate as required to maintain tolerance.
3. Maintain tight butt joints, aligned in both directions and coordinated with ceiling fixtures.

C. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

D. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.
2. Install tiles with pattern running in one direction parallel to long axis of space.
3. Install tiles with pattern running in one direction parallel to short axis of space.
4. Install tiles in a basket-weave pattern.

3.5 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 095210

ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR 4.1 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (based on cost) of the total value of the materials in the project.
LEED MR 4.2 – This credit requires the use of materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (referenced above) for a total of 20% (based on cost) of the total value of the materials in the project.
LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.2 SUMMARY

A. This Section includes the following:

1. Acoustical wall panels.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of acoustical wall panel specified.

C. Shop drawings showing fabrication and installation of acoustical wall panels including plans, elevations, sections, details of components, and attachments to other construction.
D. Samples for initial selection in 12-inch- (300-mm-) square units of each type of acoustical wall panel required and in each color, texture, and pattern indicated or selected for facing materials. Include representative samples of installation devices and accessories.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide acoustical wall panels with surface-burning characteristics as indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this Section, per ASTM Eÿ84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical wall panels with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

B. Single-Source Responsibility for Acoustical Wall Panels: Obtain each type of acoustical wall panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. LEED-Required Submittals per Division 1 Section 018113.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical wall panels from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet-work, such as concrete and plaster, has been completed and cured to a condition of equilibrium.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Do not begin installation until spaces for acoustical wall panels have been enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy. Maintain temperature and humidity as recommended by panel manufacturer.

B. Field Measurements: Check actual wall surfaces by accurate field measurements before fabrication and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating acoustical wall panels without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

1.7 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with appropriate labels:

1. Acoustical Wall Panels: Furnish quantity of full-size units equal to 2.0 percent of the amount installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL WALL PANELS, GENERAL

A. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sags, blisters, seams, adhesive or other foreign matter.

1. Fabricate back-mounted panels in factory to exact sizes required to fit wall surfaces based on field measurements of completed substrates indicated to receive acoustical wall panels.

B. Dimensional Tolerances of Finished Units: Overall height and width of panels: Plus or minus 1/16 inch (1.6 mm).

C. Sound Absorption Performance: Provide acoustical wall panels with minimum noise reduction coefficients (NRC) indicated, as determined by testing per ASTM C423 for mounting type specified under individual product requirements.

D. Colors, Textures, and Patterns: Where manufacturer's standard material is indicated, provide acoustical wall panels faced with manufacturer's material complying with the following requirements:

1. Match Architect's samples.
2. Match colors, textures, and patterns indicated by referencing manufacturer's standard designations for these characteristics.
3. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

2.2 ACOUSTICAL WALL PANELS

A. Provide acoustical wall panels in the Lecture Hall as follows:

1. Manufacturer: Armstrong or architecture approved equal.
2. Product: Soundsoak.
3. Substrate: Fiberglass.
4. Finish: Woven fabric; FR-701 85; Donegal Tweed 85.
5. Color: To be chosen by architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of acoustical wall panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories indicated or, if none indicated, as recommended by manufacturer.

1. Cut units to be at least 50 percent of unit width, with facing material extended over cut edge to match uncut edge. Scribe acoustical wall panels to fit adjacent work. Butt joints tightly.

B. Construction Tolerances: As follows:

1. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm).
2. Variation of Joints from Hairline: Not more than 1/16 inch (1.6 mm).

C. Remove and replace panels that are damaged and are unacceptable to Architect.

3.3 CLEANING

A. Clean panels with fabric facing, upon completion of installation, to remove dust and other foreign materials from the facing, using a dry brush, a vacuum, or both.

B. Clean panels with vinyl facing, upon completion of installation, to remove dust and other foreign materials from the facing, using warm water and a clean sponge; wipe dry.

C. Remove surplus materials, rubbish, and debris resulting from acoustical wall panel installation, upon completion of the Work, and leave areas of installation in a neat and clean condition.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that acoustical wall panels are without damage or deterioration at the time of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired, in a manner acceptable to the Architect, prior to the time of Substantial Completion.

END OF SECTION 09521

SECTION 096500

RESILIENT FLOORING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Vinyl composition tile (VCT).
   2. Resilient wall base, reducer strips, and other accessories.
   3. Independent testing of concrete.

B. Related Sections include the following:
   1. Division 1 Section "Sustainable Design Requirements"
   2. Division 14 Section "Hydraulic Elevator" for work of this Section.

1.3 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. Product Data: For each type of product indicated.

C. Samples: For each type of product indicated. Samples shall be in form of manufacturer's color charts consisting of the following:
   1. Resilient Accessories: Color charts consisting of strips of resilient base showing the full range of colors available for each product exposed to view.

D. Moisture, Relative Humidity, and Alkalinity and Adhesion Tests: Provide results of specified moisture, relative humidity, and alkalinity and adhesion tests and manufacturer's written moisture and alkalinity requirements for each resilient flooring type specified.

E. Product Certifications: Signed by resilient flooring manufacturer of products supplied that products comply with specifications and local regulations controlling use of volatile organic compounds (VOC's).
   1. Flooring manufacturers shall certify that proposed adhesives are acceptable for use with each type of floor covering.

F. Maintenance Data: For resilient products to include in maintenance manuals.

G. LEED Submittals:

   1. Credit EQ 4.1: Manufacturers' product data for adhesives and sealants, including printed statement of VOC content.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Smoke Density: Less than 450 per ASTM E 662.
   2. Critical Radiant flux: 0.45 watts per sq. cm or more per ASTM C 648.

B. Source Limitations for Floor Tile: Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver resilient flooring materials and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing name of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces and rolls upright.

C. Move flooring materials and accessories and installation products into spaces where they will be installed at least 48 hours in advance of installation. Do not install flooring materials until they are at same temperature as space where they are to be installed.

1.6 PROJECT CONDITIONS

A. Maintain ambient and substrates temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

1.7 SEQUENCING AND SCHEDULING

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive as determined by manufacturer's recommended bond and moisture test.

C. Contractor to coordinate project schedule to complete work by other trades and vacate areas receiving floor coverings, stopping pedestrian traffic over newly installed flooring until curing and drying period is complete. Contractor to conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing and drying periods of floor coverings.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish 1 box for every 100 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
   2. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet for every 750 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 VINYL COMPOSITION TILE

A. Vinyl Composition Tile, VCT: ASTM F 1066.
   1. Product: Mannington Essentials / Designer Essentials
   2. Class: 2 (through-pattern tile).
   3. Wearing Surface: Smooth.
   4. Thickness: 0.125 inch.
   5. Size: 12 by 12 inches.
   6. Colors: As indicated in Materials Legend.
   7. Fire-Test-Response Characteristics:
      a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.3 RESILIENT WALL BASE

A. Insert drawing designation, e.g., WB-1

B. Wall Base, WB: ASTM F 1861.
Manufacturers: Vinyl Wall Base; Johnsonite or architectural approved equal.

C. Type (Material Requirement): TV (vinyl).

D. Group (Manufacturing Method): I (solid).

E. Style: Cove (with top-set toe) and straight (toeless) at carpet.

F. Minimum Thickness: 0.125 inch.

G. Height: 4 inches.

H. Lengths: Coils in manufacturer's standard length.

I. Outside Corners: Job formed.

J. Inside Corners: Job formed.

K. Surface: Smooth.

L. Colors: As indicated in Materials Legend.

2.4 RESILIENT MOLDING ACCESSORY

A. Manufacturer: Johnsonite or architectural approved equal.

B. Material: Vinyl.

C. Transition Strips: The following product identification numbers are for products manufactured by Johnsonite. Provide listed products or equal from one of listed manufacturers.
1. Carpet to Resilient: No. CTA-XX-D.
2. Resilient to Concrete: No. RRS-XX-C.
3. Carpet to Concrete: No. EG-XX-G.
4. Corner for carpet at stair edge.

2.5 RESILIENT STAIR ACCESSORIES Resilient Stair Treads:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
b. Endura Rubber Flooring; Division of Burke Industries, Inc.
c. Flexco, Inc.
d. Johnsonite.
e. Musson, R. C. Rubber Co.
f. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
g. Roppe Corporation, USA.

B. Resilient Stair Treads Standard: ASTM F 2169.

1. Material Requirement: Type TV (vinyl, thermoplastic).
2. Surface Design:
   a. Class 2, Pattern: Raised-disc design.
3. Manufacturing Method: Group 1, tread with embedded abrasive strips.

C. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.

D. Nosing Height: 1-1/2 inches (38 mm).

E. Thickness: 1/4 inch (6 mm) and tapered to back edge.

F. Size: Lengths and depths to fit each stair tread in one piece.

G. Thickness: 0.125 inch (3.2 mm).

H. Colors and Patterns: As selected by Architect from full range of industry colors.

2.6 INSTALLATION MATERIALS

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

C. Adhesives: Premium grade, water-resistant type acceptable to manufacturer to suit resilient products and substrate conditions indicated.
1. Provide spray adhesive for VCT.
2. VCT adhesive shall have a VOC level of no more than 50 g/L.
3. Rubber floor adhesive shall have a VOC level of no more than 60 g/L.
4. Cove base adhesive shall have a VOC level of no more than 50 g/L.
5. Subfloor adhesive shall have a VOC level of no more than 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. If conditions detrimental to work are encountered, prepare written report, signed by Installer, documenting unsatisfactory conditions and send to the Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Verify that substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer, and with the specified requirements.
2. An independent testing agency shall perform calcium chloride moisture tests, relative humidity test, alkalinity tests, and adhesion test. Testing shall be conducted as follows:
   a. Maintain a minimum temperature of 70 deg F in spaces to receive flooring for at least 72 hours prior to and during the tests.
   b. Perform the tests at rate of not less than 1 test/1000 sq. ft. of floor area for slabs-on-grade and 1 test/ 2000 sq. ft. of floor area for elevated slabs.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests in accordance with recommendation of flooring manufacturer and the following specified requirements:
   a. Anhydrous Calcium Chloride Moisture Tests: Perform in accordance with ASTM F 1869, except tests shall not deduct area of $CaCl^2$ dish.
   b. Relative Humidity Test: Conduct in accordance with ASTM F 2170.

5. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, relative humidity tests are acceptable, and meet manufacturer's requirements for relative humidity and alkalinity and adhesion.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, saw cuts, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT FLOOR COVERING INSTALLATION, GENERAL

A. Install in accordance with floor covering manufacturer's written instructions and requirements of this Section.

B. Scribe, cut, and fit floor covering to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

C. Extend floor covering into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor covering as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

E. Delete first paragraph below if no covers.

G. Install floor covering on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of floor covering installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

F. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter. Install tiles square with room axis, unless otherwise indicated.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
Verify pattern and grain direction with Architect prior to installation.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Revise below if other than full-spread adhesive method is recommended by tile manufacturer for substrate and tile products selected.

H. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Hand roll tiles where required by tile manufacturer.

3.5 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required. Provide on fronts and exposed sides and backs of floor-mounted casework. Where toe space is less than base height, cut down base to proper height.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. Job-Formed Corners: Provide job-formed corners everywhere, except as noted, as follows:
1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
3. Adhere base to substrate with contact adhesive 12 inches each side of outside corner to properly hold base in permanent proper position in tight contact with wall. Base shall run continuous around corners with butt joints 12 inches minimum for corner.

3.6 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.7 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation of resilient floor coverings and accessories:
   1. Remove adhesive and other blemishes from exposed surfaces using cleaner recommended by resilient floor coverings manufacturers.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a. Do not wash surfaces until after time period recommended by manufacturer.
   4. Not more than 7 days after completion of installation, apply 1 coat of sealer/wax to a clean, dry floor covering per manufacturer's requirements, protecting surface with uniform coating and gloss. Work shall be done by a floor care subcontractor.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

   1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturers.
      a. Coordinate selection of floor polish with Owner's maintenance service.
   2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
   3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Final cleaning, polishing and buffing specified in Division 1 Section "Closeout Procedures."

END OF SECTION 09650

SECTION 096800

CARPET

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes carpet.

B. Related Sections include the following:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 9 Section "Resilient Flooring" for resilient wall base and accessories installed with carpet.

1.03 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.

C. Shop Drawings: Show the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Seam locations, types, and methods.
4. Type of installation for each type of substrate.
5. Pattern type, repeat size, location, direction, and starting point.
6. Type, color, and location of edge, transition, and other accessory strips.
7. Transition details to other flooring materials.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet: 12-inch- square Sample.
2. Carpet Seam: 6-inch Sample.

E. Test Results: Provide results of specified moisture tests, alkalinity and adhesion tests, and manufacturer's written moisture requirements for each type of carpet specified.

F. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:
1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

2. Precautions for cleaning materials and methods that could be detrimental to carpet.

G. Warranties: Special warranties specified in this Section.

H. 1. Credit EQ 4.1: Manufacturers' product data for installation adhesive used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

2. Credit EQ 4.3: Manufacturers' product data for carpet, carpet cushion, and installation adhesive, including printed statement of VOC content.

3. Credits MR 4.1 and MR 4.2: Product data indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content, including printed statement indicating costs for each product having recycled content.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain each type of carpet through a single source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at project site to comply with requirements of Division 1 Section "Project Meetings." Review specified moisture test results, alkalinity and adhesion tests, ambient conditions, ventilation procedures, installation process, adhesive application, seam sealing procedures and seam layouts.

1. Contractor to coordinate project schedule to complete work by other trades and vacate areas receiving floor coverings, stopping pedestrian traffic over newly installed flooring until curing and drying period is complete. Contractor to conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing and drying periods of floor coverings.

1.05 LAYOUT

A. Seam Layout: Layout differing from approved Shop Drawings shall be sufficient reason for rejection.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

B. Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.

C. Store materials on-site in original undamaged packages, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, with continuous blocking off floor.

1.07 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at and will continuously maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.08 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to failure of substrate, vandalism, or abuse. Warranty shall not require the use of chair pads. Failures include, but are not limited to, edge raveling, snags, zippering, backing resiliency loss, and delamination.
1. Warranty Period: 10 years for surface wear including more than 10 percent loss of face fiber.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Carpet: Full-width rolls equal to 3 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.01 CARPET

A. Carpet: CPT A: Shall be selected from Blueridge Modular Tile Color Blocks Commercial Carpet, no seconds or imperfections shall be acceptable. Carpet shall meet the following minimum construction.

1.	Construction:	Multi-Level Pattern Loop
2.	Pile Fiber and Type:	100% Zeftron Environ6ix®w/ minimum 25%
3.	Dye Method:	Solution dyed.
4.	Yarn Weight:	20 Ounces Per Sq. Yd (678 g/m2
5.	Backing System:	100% Synthetic/EnvironFlex® Performance Backing w/ 40% Recycled contents
6.	Width:	24"x24"

7.	Carpet Style and Color:	As selected by Architect from full range of options within collection.

B. Carpet: CPT B & C: Shall be selected from Corporate Values Collection by J & J Commercial Carpets; no seconds or imperfections shall be acceptable. Carpet shall meet the following minimum construction:

1.	Construction:	Textured loop.
2.	Pile Fiber and Type:	J&J Encore SD Ultima, Bulked Continuous Filament.
3.	Dye Method:	Solution dyed.
4.	Yarn Weight:	Not less than 24 oz./sq. yd.
5.	Backing System:	ActonBac LTP.
6.	Width:	12 feet.
7.	Carpet Style and Color:	As selected by Architect from full range of options within collection.

C. Carpet D: Walk off matt used at air locks and entrances.

1.	Construction:	Needle Punch.
2.	Yarn:	65% Nylon; 27.5% Animal Hair; 17.5% Polyester.
3.	Yarn Weight/Tufted:	41 ounces/yard squared.
4.	Smoke:	(ASTM E-662) ≤ 450.
5.	Pattern and Color:	Flor-S with color to be chosen by Architect.
6.	Acceptable Manufacturers:	Interface

2.02 INSTALLATION ACCESSORIES

A. Product shall comply with South Coast Air Quality Management District (SCA!MD) Rule #1168 effective date of July 1, 2005 and rule amendment date of January 7, 2005:
Architectural Non Porous Sealant Primer: 250 g/L
Architectural Porous Sealant Primer: 775 g/L
All Other Sealant Primers: 750 g/L

B. Concrete Slab Primer: Nonstaining type provided by or recommended by the carpet manufacturer.

C. Trowelable Leveling and Patching Compounds: Portland-cement-based formulation provided by or recommended by the carpet manufacturer.

D. Adhesives: Premium grade, water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the carpet manufacturer, permitting a moisture emission rate up to 5 lb/1000 sq. ft./24 hours.
1. Product: Commercialon Premium Carpet Adhesive.

E. Seaming Cement: Adhesive product recommended by carpet manufacturer for sealing seams and butting cut edges at backing to form secure watertight seams and to prevent pile loss at seams.
1. Commercialon Premium Carpet Seam Sealer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.

B. Examine carpet for type, color, pattern, and potential defects.

C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer, and with the following specified requirements:
      a. An independent testing agency shall perform alkalinity and adhesion tests, calcium chloride moisture tests, and relative humidity tests.
         1) Perform tests on slabs to receive glue down carpet installation at rate of 1 test/1000 sq. ft. of floor area for slabs-on-grade and 1 test per 2000 sq. ft. of floor area for elevated slabs.
         2) Maintain a minimum temperature of 70 deg F in spaces to be tested for at least 72 hours prior to and during the tests.
      b. Alkalinity and Adhesion Testing: Shall result in pH range recommended by carpet and carpet tile manufacturers when subfloor is wetted with potable water and pHydrion paper is applied. Perform pH tests on concrete floors regardless of age or grade level.
      c. Calcium Chloride Moisture Tests: Tests shall be conducted in accordance with ASTM F 1869-02, except that area of $CaCl^2$ dish shall not be deducted.
      d. Relative Humidity Test: Conduct in accordance with ASTM F 2170.
   2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
   4. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, relative humidity tests are acceptable, and meet manufacturers' requirements for alkalinity and adhesion.

D. If conditions detrimental to work are encountered, prepare written report, signed by Installer, documenting unsatisfactory conditions and send to the Architect.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Level subfloor within 1/4 inch in 10 feet, noncumulative, in all directions using product recommended by manufacturer. Sand or grind protrusions, bumps, and ridges.
   1. Use leveling and patching compounds to fill cracks, holes, and depressions in subfloor as recommended by carpet manufacturer.

D. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Concrete Subfloor Preparation: Apply concrete slab primer, according to manufacturer's directions, where recommended by the carpet manufacturer.

3.03 INSTALLATION

A. Comply with carpet manufacturer's written installation instructions.

B. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation" and carpet manufacturer's installation procedures and requirements.

C. Comply with carpet manufacturer's written recommendations and approved Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

D. Where demountable partitions or other items are indicated for installation on top of finished carpet, install carpet before installation of these items.

E. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

F. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.

3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer to ensure carpet is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09680

SECTION 099123

PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED IEQ Credit 4.2 – Paints and coatings used on the interior of the building and applied on-site must comply with the following VOC criteria:

1. Architectural paints, coatings and primers applied to interior walls and ceiling are not to exceed VOC limits in Green Seal Standard GS-11 (5/20/1993); Flats 50 g/L, Non-Flats 150 g/L.
2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates are not to exceed VOC content of 250 g/L per Green Seal Standard GC-03 (1/7/1997).
3. Clear wood finishes, floor coatings, stains, sealers and shellacs applied to interior are not to exceed VOC limits per South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings (1/1/2004); Clear wood finishes – Varnish 350 g/L, Lacquer 550 g/L; Floor coatings 100 g/L; Sealers – Waterproofing sealers 250 g/L, Sanding sealers 275 g/L, All other sealers 200 g/L; Shellacs – Clear 730 g/L, Pigmented 550 g/L; Stains 250 g/L.

1.02 SUMMARY

A. This Section includes the following:
   1. Exposed exterior items and surfaces with low VOC coatings.
   2. Exposed interior items and surfaces with low VOC coatings.
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Related Sections include the following:
   1. Division 1 Section "Sustainable Design Requirements"
   2. Division 2 Sections for traffic-marking paint.
   3. Division 4 Section "Unit Masonry Assemblies" for preparation of concrete masonry.
   4. Division 5 Section "Structural Steel" for shop priming structural steel.
   5. Division 5 Section "Metal Deck" for shop finish on metal deck to be field finished.
   6. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
   7. Division 6 Section "Finish Carpentry" for surface preparation of exterior porch railings, window sills, and interior finish carpentry.
   8. Division 6 Section "Architectural Woodwork" for shop finishing of architectural casework.
   9. Division 6 Section "Fiber-Cement Siding" for factory primer/sealer and first finish coat on fiber-cement siding and trim.
   10. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.

11. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
12. Review all sections for shop primed items requiring field painting.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. Product Data: For each paint system indicated. Include block fillers and primers. Include manufacturer's printed statement of VOC content for each product.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Mix Code: Provide color mix codes for all paint colors.

C. Schedule: Provide schedule of all surfaces to be coated, with prime and finish coat material listed, and manufacturer's recommended wet film thickness.

D. Samples: For each type of exposed finish required, submit color chips, 3- by 5-inches, matching colors indicated on Finish Schedule.

E. Qualification Data: For Applicator.

F. LEED Submittals: 1. Credit EQ 4.2: Manufacturers' product data for paints and coatings, including printed statement of VOC content and chemical components and material safety data sheets (MSDS).

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Duplicate finish of approved sample Submittals.
   1. Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
      a. Wall Surfaces: Provide samples of at least 100 sq. ft.
      b. Small Areas and Items: Architect will designate items or areas required.
   2. After permanent lighting and other environmental services have been activated, apply benchmark samples, according to requirements for the completed Work. Provide required sheen, color, and texture on each surface.
      a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from benchmark samples.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly.
   2. Remove oily rags and waste daily.
   3. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.07 PROJECT CONDITIONS

A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
   2. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

1.08 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
   1. Quantity: Furnish Owner with not less than 1 gal., of each material and color applied for Owner's use during move in.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Benjamin Moore & Company (Moore).
   2. ICI Dulux Paints (ICI).
   3. Sherwin-Williams Co. (S-W).
   4. Tnemec Company, Inc. (Tnemec).

2.02 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best quality coating material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers listed in the specification schedule. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
   2. Where schedule says no substitution, use proprietary product only. Do not propose substitution, as the products from the other manufacturers have been considered, and are not acceptable.

C. VOC Compliance: Paints and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the following criteria:
   1. Architectural paints, coatings and primers applied to the interior walls and ceilings: Do not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.
      a. Flats: 50 g/L
      b. Non-Flats: 150 g/L
   2. Anti-corrosive ant anti-rust paints applied to interior ferrous metal substrates: Do not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997.
   3. Clear wood finishes, floor coatings, stains, and shellacs applied to interior elements: Do not exceed the VOC content limits established in South Coast Air Quality

Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

a. Clear wood finishes: Varnish 350 g/L; Lacquer 550 g/L
b. Floor coatings: 100 g/L
c. Sealers: Waterproofing sealers 250 g/L; Sanding sealers 275 g/L; all other sealers 200 g/L
d. Shellacs: Clear 730/g/L; Pigmented 550 g/L
e. Stains 250 g/L

C. Colors: Provide color selections made by the Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, under which painting will be performed for compliance with paint application requirements.
   1. If unacceptable conditions are encountered, prepare written report, endorsed by Applicator, listing conditions detrimental to performance of work.
   2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Application of coating indicates Applicator's acceptance of surfaces and conditions within a particular area.
   4. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of specified finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete, and concrete unit masonry surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze.
   a. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   b. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   c. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
   c. If transparent finish is required, backprime with spar varnish.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
5. Galvanized Surfaces: Uniformly abrade galvanized surfaces with a palm sander and 60 grit aluminum oxide so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
   a. Clean field welds with nonpetroleum-based solvents so surface is free of oil and surface contaminants.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Paint all exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color-coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment at all locations except mechanical and electrical rooms.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

E. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions. Walls shall have roller finish.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.

2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

F. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

G. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in occupied spaces (outside mechanical and electrical rooms).

H. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers and supports.
2. Heat exchangers.
3. Tanks.
4. Ductwork, including interior of ductwork visible through air devices.
5. Insulation.
6. Motors and mechanical equipment.
7. Exposed rooftop units.
8. Accessory items.

I. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

J. Block Fillers: Apply block fillers to concrete masonry units at a rate to ensure complete coverage with pores filled.

K. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

L. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

M. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats, unless otherwise noted.

N. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

O. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

P. Exterior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following (New and Existing):
1. Exposed structural steel and lintel plates.
   a. Galvanized single angle lintels do not require painting.
2. Steel doors and frames.
3. Bollards.
4. Metal Fabrications. See Section 05500.
5. Factory primed louvers.
6. Miscellaneous metal items, including galvanized steel.

Q. Interior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following:
1. Steel doors and frames, including frames for borrowed lites.
2. Steel stairs, including risers and stringers.
3. Handrails and guardrails.
4. Lintel plates and angles.
5. Exposed construction, including metal deck.
6. Wood door glass lite kits and astragals.
7. Access panels (both sides).
8. Metal fabrications. See Section 05500.
9. Miscellaneous metal items.

3.04 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the Project site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.05 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 LOW VOC EXTERIOR PAINT SCHEDULE (See 2.02.C for VOC Requirements)

A. Concrete (Other Than Concrete Unit Masonry): Provide the following finish systems over exterior concrete substrates:
1. Flat, Sand Textured Acrylate Finish: 2 finish coats over a filler as required.
   a. Concrete Filler: Fill voids, bug holes and other cavities with epoxy modified mortar.

1) Tnemec: Series 218 MortarClad.

b. First and Second Coats: Flat, sand textured, exterior, modified waterborne acrylate paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Tnemec: Series 157 Enviro-Crete; 8.0 mils per coat.

B. Exterior Gypsum Soffit Board: Provide the following finish systems over exterior gypsum soffit board:
1. Flat Acrylic Finish: 2 finish coats over an exterior, alkyd- or alkali-resistant primer, as recommended by the manufacturer.
a. Primer: Exterior, alkyd- or alkali-resistant, acrylic-latex primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Moorcraft Super Spec Latex Exterior Primer No. 169; 1.4mils DFT.
2) ICI: 2000-1200 Dulux Professional Exterior 100% Acrylic Latex Primer; 1.6 mils DFT.
3) S-W: A-100 Exterior Latex Wood Primer B42W41; 1.4 mils DFT.
b. First and Second Coats: Flat, exterior, acrylic-emulsion paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Moorcraft Super Spec Exterior Flat Latex House Paint No. 189; 2.4 mils DFT.
2) ICI: 2200-XXXX Dulux Professional Exterior 100 Percent Acrylic Flat Finish; 2.8 mils DFT.
3) S-W: Duration Exterior Latex Coating; 5.6 mils DFT.

C. Wood Trim, Opaque Finish: Provide the following finish systems over smooth, exterior wood surfaces:
1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
a. Primer: Exterior, stain blocking, alkyd, wood primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Moorcraft Super Spec Alkyd Exterior Primer No. 176; 1.8 mils DFT.
2) ICI: 2110-1200, Ultra-Hide Durus Exterior Alkyd Primecoat; 1.4 DFT.
3) S-W: A-100 Exterior OilWood Primer Y24A100; 2.3 mils DFT.
b. First and Second Coats: Semigloss, waterborne, exterior, acrylic enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Moorcraft Super Spec Latex House & Trim Paint No. 170; 2.2 mils DFT.
2) ICI: 2416-XXXX, Ultra-Hide Durus Exterior Acrylic Semi-Gloss Finish; 3.0 mils DFT.
3) S-W: Duration Exterior Satin Latex Coating; 5.6 mils DFT.

D. Fiber-Cement Siding and Trim: Provide the following finish systems over exterior fiber-cement substrates:

1. Low-Luster Acrylic Finish: 1 coat of acrylic finish over shop applied primer and first finish coat specified in Division 7 Section "Fiber Cement Siding":
   a. Second Finish Coat: Low-luster (eggshell or satin), exterior, 100% acrylic paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 6 mils.
      1) Cabot: The Finish with Teflon Surface Protector, #1700 Series.

E. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
   1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.
      a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
         1) Moore: Moore's IMC M04 Acrylic Metal Primer; 2.0 mils DFT.
         2) ICI: 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish; 2.2 mils DFT.
         3) S-W: Galvite HS, B50WZ30; 3.5 DFT.
      b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
         1) Moore: Moorcraft Super Spec Latex House & Trim Paint No. 170; 2.2 mils DFT.
         2) ICI: 2416-XXXX, Ultra-Hide Durus Exterior Acrylic Semi-Gloss Finish; 3.0 DFT.
         3) S-W: Duration Exterior Gloss Latex Coating; 5.6 mils DFT.

F. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:
   1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
      a. Primer: Metal primer applied to galvanized metals not previously shop-primed applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
         1) Moore: Moore's IMC Acrylic Metal Primer No. M04; 2.0 mils DFT.
         2) ICI: 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish; 2.5 mils DFT.
         3) S-W: Galvite HS Paint B50WZ30; 3.5 mils DFT.
      b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
         1) Moore: Moorcraft Super Spec Latex House & Trim Paint No. 170; 2.2 mils DFT.
         2) ICI: 2416-XXXX, Ultra-Hide Durus Exterior Acrylic Semi-Gloss Finish; 3.0 DFT.
         3) S-W: Duration Exterior Gloss Latex Coating; 5.6 mils DFT.

G. Aluminum: Provide the following finish systems over exterior aluminum surfaces. Primer is not required on shop-primed items.
   1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
      a. Primer: Rust-inhibitive, acrylic- or alkyd-based, metal primer, as recommended by the manufacturer for use over aluminum, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.

1) Moore: Moore's IMC Acrylic Metal Primer No. M04; 2.0 mils DFT.
2) ICI: 4020-XXXX Devflex DTM Flat Interior/Exterior Waterbcorne Primer & Finish; 2.2 mils DFT.
3) S-W: DTM Acrylic Primer/Finish B66W1; 2.5 mils DFT.

b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Moorcraft Super Spec Latex House & Trim Paint No. 170; 2.2 mils DFT.
2) ICI: 2416-XXXX, Ultra-Hide Durus Exterior Acrylic Semi-Gloss Finish; 3.0 DFT.
3) S-W: Duration Exterior Gloss Latex Coating; 5.6 mils DFT.

3.07 LOW ODOR/LOW VOC INTERIOR COATINGS

A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements in paragraph 2.02.C of this Section.

B. Concrete Plank: Provide the following paint systems over interior concrete surfaces:
1. Semigloss, Acrylic-Enamel Finish, Ceilings: 2 finish coats over a block filler.
a. Block Filler: Low odor/low VOC, high-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Latex Block Filler No. M88; 8.0 mils DFT.
2) ICI: Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler; 7.0 mils DFT.
3) S-W: Loxon Block Surfacer A24W200; 8.0 mils DFT.
b. First and Second Coats: Low odor/low VOC, semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: EcoSpec Interior Latex Semi-Gloss Enamel No. 224; 2.8 mils DFT.
2) ICI: 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel; 3.0 mils DFT.
3) S-W: ProMar 200 Interior Latex Semi-Gloss, B31-2200 Series; 3.0 DFT.

C. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:
1. Semigloss, Acrylic-Enamel Finish, Walls: 2 finish coats over a block filler.
a. Block Filler: Low odor/low VOC, high-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Latex Block Filler No. M88; 8.0 mils DFT.
2) ICI: Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler; 7.0 mils DFT.
3) S-W: PrepRite Block Filler B25W25; 8.0 mils DFT.
b. First and Second Coats: Low odor/low VOC, semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Eco Spec Interior Latex Semi-Gloss Enamel No. 224; 2.8 mils DFT.

2) ICI: 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel; 3.0 mils DFT.
3) S-W: ProMar 200 Interior Latex Semi-Gloss, B31-2200 Series; 3.0 DFT.

D. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
1. Semigloss, Acrylic-Enamel Finish, Walls and Ceilings: 2 finish coats over a primer.
a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: EcoSpec Interior Latex Primer Sealer No. 231; 1.0 mils DFT.
2) ICI: 1030-1200, Ultra-Hide PVA Interior Primer-Sealer General Purpose Wall Primer; 1.9 mils DFT.
3) S-W: PrepRite 200 Interior Latex Primer B28W200 Series; 1.6 mils DFT.
b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product. Ceiling paint shall contain mildewcide.
1) Moore: EcoSpec Interior Latex Semi-Gloss Enamel No. 224; 2.8 mils DFT.
2) ICI: 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel; 3.0 mils DFT.
3) S-W: ProMar 200 Interior Latex Semi-Gloss, B31-2200 Series; 3.0 DFT.

E. Natural-Finish Woodwork: Provide the following natural finishes over new, interior woodwork:
1. Waterborne, Satin-Varnish Finish: 3 finish coats of a waterborne, clear-satin varnish.
a. First, Second and Third Finish Coats: Waterborne, varnish finish applied at spreading rate recommended by the manufacturer.
1) Moore: Stays Clear Acrylic Polyurethane #423, Satin.
2) ICI: WoodPride Aquacrylic 1802-0000.
3) S-W: Minwax Polycrylic.

F. Ferrous and Zinc-Coated Metal: Provide the following finish systems over ferrous metal:
1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
a. Primer: Quick-drying, corrosion resistant, acrylic primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: I.M.C. Acrylic Metal Primer M04; 2.0 mils DFT.
2) ICI: 4020-XXXX DTM Flat Interior/Exterior Waterborne Primer & Finish; 3.0 mils DFT.
3) S-W: Pro-Cryl Universal Water Based Primer, B66-310 Series; 3.0 mils DFT.
b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Eco Spec Interior Latex Semi-Gloss Enamel No. 224; 2.8 DFT.
2) ICI: 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel; 3.0 mils DFT.

3) S-W: ProMar 200 Interior Latex Semi-Gloss B31-2200 Series; 3.0 mils DFT.

G. Telecommunication and Electrical Backboards: Provide the following finish over plywood:
1. Flat Intumescent Finish: Two finish coats over a primer.
a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
1) Moore: Pristine EcoSpec Interior Latex Primer Sealer 231; 0.8 mils DFT.
b. First and Second Coats: Intumescent-type, fire-retardant paint applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 4 mils; white color for telecommunication and black for electrical.
1) Moore: M59 220 Latex Fire-Retardant Coating.

H. Fire-Rating Identification: Identify all 1- and 2-hour fire-rated partitions by stenciling rating on each side of rated walls above ceiling line with 4 inch high, Helvetica Bold letters in red or orange semigloss paint; each rated wall shall be identified at least once and at a spacing not greater than 12'-0" o.c.
1. First Coat: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
a. Moore: Eco Spec Interior Latex Semi-Gloss Enamel No. 224; 1.4 DFT.
b. ICI: 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel; 1.5 mils DFT.
c. S-W: ProMar 200 Interior Latex Semi-Gloss B31-2200 Series; 1.5 mils DFT.

I. Floor Identification for Stairwell Doors: Identify floor level on stairwell side of each stairwell door by stenciling doors with 12 inch high, Helvetica Bold letters at center of door in black semigloss paint.
1. First Coat: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
a. Moore: Eco Spec Interior Latex Semi-Gloss Enamel No. 224; 1.4 DFT.
b. ICI: 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel; 1.5 mils DFT.
c. S-W: ProMar 200 Interior Latex Semi-Gloss B31-2200 Series; 1.5 mils DFT.

Paint			Ceiling - white	PT0
	Benjamin Moore	ready mix	Antique White	PT1
	Benjamin Moore	HC-143	Wythe Blue	PT2
	Benjamin Moore	997	Baja Dunes	PT3
	Benjamin Moore	118	Grand Canyon (pumpkin)	PT4
	Benjamin Moore	143	Golden Light (yellow)	PT5
	Benjamin Moore	2084-20	Maple leaf red	PT6
	Benjamin Moore	HC-159	Philipsburg Blue	PT7
	Benjamin Moore	TBD		PT8
	Benjamin Moore	TBD		PT9
	Benjamin Moore	TBD		PT10
		TBD		PT11

END OF SECTION 099123

SECTION 10155

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes stock, manufactured toilet compartments.

B. Types of toilet compartments include:

1. Metal, baked enamel finish.

C. Styles of toilet compartments include:

1. Floor-anchored.

D. Styles of screens include:

1. Wall-hung.

E. Toilet accessories, such as toilet paper holders, grab bars, and purse shelves, are specified in another Division 10 Section.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for materials, fabrication, and installation including catalog cuts of anchors, hardware, fastenings, and accessories.

C. Shop drawings for fabrication and erection of toilet compartment assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work.

D. Samples of full range of colors for each type of unit required. Submit 6-inch-square samples of each color and finish on same substrate to be used in work, for color verification after selections have been made.

1.4 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of work. However, allow for adjustments where taking of field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorage which must be built into other work for installation of toilet compartments and related items. Coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Steel - Baked Enamel Finish:
   a. Accurate Partition Corp.
   b. All American Metal Corp.
   c. American Sanitary Partition Corp.
   d. Ampco Products, Inc.
   e. Flush-Metal Partition Corp.
   f. General Partitions Manufacturing Corp.
   g. Global Steel Products Corp.
   h. Knickerbocker Partition Corp.
   i. Lambaton-Universal Metal Products.
   j. Metpar Steel Products Corp.
   k. The Mills Company.
   l. Monarch Toilet Partitions, Inc.
   m. Sanymetal Products Co.
   n. Weis/Robart Partitions, Inc.

2.2 MATERIALS

A. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

B. Steel Sheets for Baked Enamel Finish: ASTM A 591, Class C, galvanized-bonderized, of following minimum thicknesses:

1. Pilasters (overhead-braced): 0.0396 inch (20 gage).
2. Pilasters (unbraced): 0.0516 inch (18 gage).
3. Panels and Screens: 0.0396 inch (20 gage).
4. Doors: 0.0336 inch (22 gage).

C. Concealed Anchorage Reinforcement: Minimum 0.108 inch (12 gage), galvanized steel sheet.

D. Concealed Tapping Reinforcement: Minimum 0.0785 inch (14 gage), galvanized steel sheet.

E. Core Material for Metal Partitions: Manufacturer's standard sound-deadening honeycomb of impregnated Kraft paper in thickness to provide finished dimension of 1 inch minimum for doors, panels, and screens and 1-1/4 inches minimum for pilasters.

F. Pilaster Shoes and Caps: ASTM A 167, Type 302/304 stainless steel, not less than 3 inches high, 0.0396 inch thick (20 gage), finished to match hardware.

G. Stirrup Brackets: Manufacturer's standard design for attaching panels to walls and pilasters, either chromium-plated nonferrous cast alloy ("Zamac") or anodized aluminum.

H. Hardware and Accessories: Manufacturer's standard design, heavy duty operating hardware and accessories of chromium-plated, nonferrous cast alloy ("Zamac").

I. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass, finished to match hardware, with theft-resistant-type heads and nuts. For concealed anchors, use hot-dip galvanized, cadmium-plated, or other rust-resistant protective-coated steel.

2.3 FABRICATION

A. General: Furnish standard doors, panels, screens, and pilasters fabricated for compartment system. Furnish units with cutouts, drilled holes, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated.

B. Door Dimensions: Unless otherwise indicated, furnish 24-inch-wide in-swinging doors for ordinary toilet stalls and 32-inch-wide (clear opening) out-swinging doors for stalls equipped for use by handicapped.

C. Metal Toilet Compartments and Screens: Pressure laminate seamless face sheets to core material and seal edges with continuous interlocking strip or with lapped and formed edges. Weld edges and corners with exposed welds ground smooth.

D. Floor-Supported Compartments: Furnish galvanized steel anchorage devices complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters to permit structural connection at floor. Provide shoe at each pilaster to conceal anchorage.

E. Wall-Hung Screens: Furnish panel units in sizes indicated, of same construction and finish as partition system panels.

F. Hardware: Furnish hardware for each compartment to comply with ANSI A117.1 for handicapped accessibility and as follows:

1. Hinges: Cutout inset type, adjustable to hold door open at any angle up to 90 degrees. Provide gravity type, spring-action cam type, or concealed torsion rod type to suit manufacturer's standards.
2. Latch and Keeper: Recessed latch unit, designed for emergency access, with combination rubber-faced door strike and keeper.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit, designed for handicapped accessibility, with combination rubber-faced door strike and keeper.

4. Coat Hook: Manufacturer's standard unit, combination hook and rubber-tipped bumper, sized to prevent door hitting mounted accessories.
5. Door Pull: Manufacturer's standard unit for out-swinging doors. Provide pulls on both faces of handicapped compartment doors.

2.4 FINISH

A. Color: One of manufacturer's standard colors in each room, as indicated or, if not indicated, as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's recommended procedures and installation sequence. Install compartment units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch between pilasters and panels, and not more than 1 inch between panels and walls. Secure panels to walls with not less than two stirrup brackets attached near top and bottom of panel. Locate wall brackets so that holes for wall anchorages occur in masonry or tile joints. Secure panels to pilasters with not less than two stirrup brackets located to align with stirrup brackets at wall. Secure panels in position with manufacturer's recommended anchoring devices.

B. Floor-Supported Compartments: Set pilaster units with anchorages having not less than 2 inches penetration into structural floor, unless otherwise recommended by partition manufacturer. Level, plumb, and tighten installation with devices furnished. Hang doors and adjust so that tops of doors are level with tops of pilasters when doors are in closed position.

C. Screens: Attach with anchoring devices as recommended by manufacturer to suit supporting structure. Set units to provide support and to resist lateral impact.

3.2 ADJUST AND CLEAN

A. Hardware Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors (and entrance swing doors) to return to fully closed position.

B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION

SECTION 102610 - WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See LEED for New Construction Version 2.2 Reference Guide and Section 018113 – Sustainable Design Requirements. Targeted LEED Credits:

LEED MR 7 - All wood products, project-wide: Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principle and Criteria for wood building components. These components include, but are not limited to, temporary fencing, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.
LEED IEQ Credit 4.1 – VOC contents of adhesives and sealants must be less than the current VOC content limits of South Coast Air Quality Management District Rule #1168 and all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

1.2 SUMMARY

A. This Section includes the following:

1. Wall guards.
2. Corner guards.
3. Door-protection systems.

B. Related Sections include the following:

1. Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.
2. Division 05 Section "Metal Fabrications" for metal angle corner guards.
3. Division 08 Section "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Handrails: Provide handrails capable of withstanding the following structural loads without exceeding the allowable design working stress of materials for handrails, anchors, and connections:

1. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
2. Uniform load of 50 lbf/ft. (730 N/m) applied in any direction.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.

B. Shop Drawings: For each impact-resistant wall-protection unit showing locations and extent. Include sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated.

1. Include similar Samples of accent strips and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Wall and Corner Guards: 12 inches (300 mm) long. Include examples of joinery, corners, and field splices.
2. Door-Edge and Frame Protectors: 12 inches (300 mm) long.

E. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for adhesives, including printed statement of VOC content.
2. Credit MR 7: Certificates of chain-of-custody signed by manufacturers certifying that wood used to produce wood rails was obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.

F. Material Test Reports: For each impact-resistant plastic material.

G. Material Certificates: For each impact-resistant plastic material, signed by manufacturer.

H. Maintenance Data: For each impact-resistant wall-protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

I. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall-protection units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Fire-Test-Response Characteristics: Provide impact-resistant, plastic wall-protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall-protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

a. Store corner-guard covers in a vertical position.
b. Store wall-guard covers in a horizontal position.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall-protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures.
   b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 8-foot- (2.4-m-) long units.
2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- (1.2-m-) long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

PART 2 - PRODUCTS

2.1 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.
3. Basis-of-Design Product: The design for each impact-resistant wall-protection unit is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 MATERIALS

A. Extruded Rigid Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.

C. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.

D. Stainless-Steel Sheet: ASTM A 240/A 240M.

E. Brass: ASTM B 249/B 249M for extruded shapes and ASTM B 36/B 36 M for sheet.

F. Solid Wood: Clear hardwood lumber of species indicated, free of appearance defects, and selected for compatible grain and color.

G. Medium-Density Fiberboard: ANSI A208.2, Grade MD.

H. Particleboard: ANSI A208.1, Grade M-2.

I. Oriented Strand Board: APA PS2, Exposure 1 or 2, Sheathing grade.

J. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

K. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.

1. Use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Gypsum Board and Panel Adhesives: 50 g/L.
b. Multipurpose Construction Adhesives: 70 g/L.
c. Contact Adhesive: 250 g/L.

2.3 WALL GUARDS

A. Crash Rail: Heavy-duty assembly consisting of continuous snap-on plastic cover installed over continuous retainer; with continuous rubber or vinyl bumper cushion(s) centered in the retainer; designed to withstand impacts.

1. Location: **all main halls of Vivarium**
2. Available Manufacturers:

   a. American Floor Products Co., Inc.
   b. ARDEN Architectural Specialties, Inc.
   c. Balco, Inc.
   d. Construction Specialties, Inc.
   e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   f. Korogard Wall Protection Systems; Division of RJF International Corporation.
   g. Pawling Corporation.
   h. Tepromark International, Inc.

3. Cover: Extruded rigid plastic, minimum 0.100-inch (2.5-mm) wall thickness; as follows:

   a. Profile: Flat profile, nominal 6 inches high by 1 inch (150 mm high by 25 mm) deep.
   b. Color and Texture: As selected by Architect from manufacturer's full range.

      1) Accent Inlay: Nominal 2 inches (50 mm) high by length of rail.

4. Retainer: Minimum 0.080-inch- (2.0-mm-) thick, 1-piece, extruded aluminum.

   a. Mounting: Surface mounted on 1/2-inch- (13-mm-) thick cushion spacers.

5. End Caps and Corners: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
6. Accessories: Concealed splices and mounting hardware.

2.4 CORNER GUARDS

A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
1. Available Manufacturers:

   a. American Floor Products Co., Inc.
   b. ARDEN Architectural Specialties, Inc.
   c. Balco, Inc.
   d. Construction Specialties, Inc.
   e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
   f. Korogard Wall Protection Systems; Division of RJF International Corporation.

g. Pawling Corporation.
h. Tepromark International, Inc.

2. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness; [as follows:] [in dimensions and profiles indicated on Drawings.]

a. Profile: Nominal 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius.
b. Height: 4 feet (1.2 m).
c. Color and Texture: As selected by Architect from manufacturer's full range.

3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, 1-piece, extruded aluminum.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.5 FABRICATION

A. Fabricate impact-resistant wall-protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Preform curved semirigid, impact-resistant sheet wall covering in factory for radius and sheet thickness as follows:

1. Sheet Thickness of 0.040 Inch (1.0 mm): 24-inch (610-mm) radius.
2. Sheet Thickness of 0.060 Inch (1.5 mm): 36-inch (914-mm) radius.

C. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

D. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
2. For impact-resistant wall-protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall-protection units in locations and at mounting heights indicated on Drawings.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
c. Adjust end caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Provide top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.
2. Healthcare accessories.
3. Underlavatory guards.
4. Custodial accessories.

B. Owner-Furnished Material: Toilet paper, paper towel and liquid soap dispensers.

C. Related Section include the following:
1. Division 01 Section "Sustainable Design Requirements".
2. Division 09 Section "Tiling" for ceramic toilet and bath accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bobrick Washroom Equipment, Inc.

B. Toilet Tissue (Roll) Dispenser

1. Furnished by owner and installed by contractor.

C. Paper Towel (Folded) Dispenser

1. Furnished by owner and installed by contractor.

D. Liquid-Soap Dispenser

1. Furnished by owner and installed by contractor.

E. Grab Bar
1. Mounting: Flanges with concealed fasteners.
2. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.

3. Outside Diameter: 1-1/2 inches (38 mm).
4. Configuration and Length: As indicated on Drawings.

F. Mirror Unit
1. Frame: Stainless-steel channel.

a. Corners: Manufacturer's standard.

2. Size: As indicated on Drawings.

G. Robe Hook
1. Description: Double-prong unit.
2. Material and Finish: Stainless steel, No. 4 finish (satin).

H. Shower Curtain Rod, Built-In-Place Showers: Provide heavy-duty, 1-1/4-inch OD stainless-steel, minimum nominal 0.05-inch- thick stainless steel, with 3-inch stainless-steel flanges designed for exposed fasteners, in length required for shower opening indicated.
1. Products:

a. Bobrick Washroom Equipment, Inc.; Model B-6047.
b. Bradley Corporation; Model 9531-4.

I. Antibacterial Shower Curtain: Minimum 10-oz., nylon-reinforced vinyl or 0.008-inch- thick vinyl material with integral antibacterial agent and corrosion-resistant grommets at minimum 6 inches o.c. through top hem, length required for shower opening indicated. Provide white curtain.
1. Products:
a. Bobrick Washroom Equipment, Inc.; Model B-204-2.
b. Bradley Corporation; Model 9535.

J. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
1. Products:
a. Bobrick Washroom Equipment, Inc.; Model B-204-1.
b. Bradley Corporation; Model 9536.

2.3 UNDERLAVATORY GUARDS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

C. Underlavatory Guard
1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded-plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.

4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

C. Mop and Broom Holder
1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
2. Length: 36 inches (914 mm).
3. Hooks: Three.
4. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.
c. Location: One per janitor closet.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104250

SIGNAGE, BULLETIN BOARD AND CHAULK BOARDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes the following types of signs:

1. Signage
2. Building Directory
3. Dimensional Letters
4. Chaulk Boards
5. Wipe Board

1.2 SUBMITTALS

A. Division 1: Conform to the requirements of Division 1, Section 01300, "Submittals."

B. Related Section: Division 1 "Sustainable Design Requirements".

C. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

D. Shop drawings showing fabrication and erection of exterior metal signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

1. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
3. Provide message list for each directory required, including large-scale details of wording and lettering layout.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Samples for initial selection of color, pattern, and texture:
    a. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
2. Wiring diagrams from the manufacturer for illuminated signs:

a. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.
b. Dimensional letters.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Design Criteria: Design, fabricate, and install signs to withstand a wind pressure of 100 mph on the total sign area in all directions.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

B. Design Criteria: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Design Criteria: Design, fabricate, and install signs to withstand a wind pressure of 100 mph on the total sign area in all directions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work. Use metals that are compatible with one another.

B. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for the application intended.

2.2 SIGNGAGE

A. Provide a vinyl sign for every room including the number, and the name in raised letters and Braille. Additionally, for all labs include a vinyl sign with raised letters and Braille stating the following. "CAUTION Hazardous Material may be present in this laboratory. Admittance to authorized personnel only." Transparent pocket on sign will be needed to slip laboratory certification/information into.

(See Appendix) Noted below this section will read "Emergency Laboratory Information"

B. Provide signage for all rooms by Perfect Sign 207-282-1000 or architectural approved equal.

2.3 BULLETIN BOARDS

A. Provide bulletin boards with natural cork facing as noted below:
1. Manufacturer: Provide bulletin boards from a single manufacturer.
2. Provide the Series 230 from Nelson-Harkins or equal.
3. Provide wood frame constructed of natural birch. Provide reinforced corners and miter to a hairline fit, with no exposed fasteners.
4. Provide the manufacturer's standard surface mounted bulletin board assembly, fabricated to sizes indicated, consisting of the bulletin board housing with perimeter frame, sides and back, tackable surface of natural cork, and other features as indicated.

2.4 DIMENSIONAL LETTERS

A. Dimensional Letters

1.Interior Dimensional Letters:
a. Size: 6" by 3/8" thick.
b. Material: Polished Aluminum
c. Mounting: Pad mounted.
d. Font: Upper Century School Book Bold.
e. Manufacturer: Gemini, Inc. (1-800-LETTERS) or Architect approved equal.

2.5 EXTERIOR METAL SIGN

A. Exterior Illuminated Metal Signage
At the exterior entrances and interior department doors, provide curved illuminated signs (copper on exterior and brushed aluminum on interior) and details.

1. Copper Sheet or Plate: Provide alloy and temper recommended by the copper producer for the type of use indicated and not less than the strength and durability properties specified in ASTM but not less than 48 ounces.

2. Cutout Copy: Machine-cut letters, numbers, symbols, and other graphic devices through the sign panel to produce precisely formed copy. Use high-speed cutters

mechanically linked to master templates in a pantographic system or equivalent process capable of producing characters of the style indicated with sharply formed edges.

3. Edge Condition: Square.

4. Fabrication: Comply with requirements indicated for materials, thicknesses, designs, shapes, sizes, and details of construction.

   a. Allow for thermal movement resulting from a maximum ambient temperature change of 100 deg F (55.5C). Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and overstressing welds and fasteners.
   b. Welded Connections: comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of the exposed side. Clean exposed welded surfaces of welding flux and dress on all exposed and contract surfaces.
   c. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.
   d. Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.

2.6 CHAULK BOARDS

A. Visual Display Surfaces - Signage, Bulletin Board and Chalk Boards

1. Provide 2'-0" by 3'-0" directory with adjustable type in the main lobbies.
2. Add 2' x 3' white board on a hinge over exposed elec panels on third.

B. Provide horizontal sliding units in Lecture Hall as follows:

1. Manufacturer: AARCO (800-989-2348) or architecture approved equal.
2. Size: 4' x 16' B Series.
3. Series Number: 10-171.
4. Tracks: Three tracks.
5. Depth: 4".
6. Surfaces: Slate colored chaulk boards.

C. Provide cabinet chaulk boards where indicated as follows:

1. Manufacture: AARCO (800-989-2348) or architect approved equal.
2. Size: 4'-0" x 4'-0".

3. Series: 10-175.
4. Laminate Color: Black.
5. Depth: 5".
6. No movie screen include.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Set anchor bolts and other items required for installation post and panel signs. Use templates, setting drawings diagrams, instructions, and directions provided by suppliers of items to be attached.

C. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Install with fully surfaced rear faced double-stick foam adhesive tape.

1. Projected Mounting: Mount letters at the projection distance from the wall surface indicated.

3.2 CLEANING AND PROTECTION

A. At completion of the installation, clean soiled surfaces of sign units in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION 104250

SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Sections:
1. Division 1 Section "Sustainable Design Requirements"
2. Division 10 Section "Fire Extinguishers."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
2. Show location of knockouts for hose valves.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Size: 6 by 6 inches (150 by 150 mm) square.

E. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

F. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire protection cabinets including, but not limited to, the following:

a. Schedules and coordination requirements.

1.5 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: ASTM B 209 (ASTM B 209M).
2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

D. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3, [**3**] [**6**] mm thick.

E. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

F. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Fire End & Croker Corporation;
    b. J. L. Industries, Inc., a division of Activar Construction Products Group; .
    c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;
    d. Larsen's Manufacturing Company;
    e. Modern Metal Products, Division of Technico Inc.;
    f. Moon-American;
    g. Potter Roemer LLC;
    h. Watrous Division, American Specialties, Inc.;

B. Cabinet Construction: Same rating as wall that it is inserted into.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Stainless-steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
2. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Stainless-steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER"

1) Location: Applied to cabinet glazing.
2) Application Process: Silk-screened.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Finishes:
1. Stainless Steel: No. 6.

2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

   1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
   2. Provide inside latch and lock for break-glass panels.
   3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes portable, fire extinguishers and mounting brackets for fire extinguishers.

B. Owner-Furnished Material: Wheeled fire extinguishers.

C. Related Sections:

1. Division 10 Section "Fire Extinguisher Cabinets."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.

C. Remaining paragraphs are defined in Division 01 Section "Submittal Procedures" as "Informational Submittals."Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

    a. Schedules and coordination requirements.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Failure of hydrostatic test according to NFPA 10.
    b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Amerex Corporation.
    b. Ansul Incorporated; Tyco International Ltd.
    c. Badger Fire Protection; a Kidde company.
    d. Buckeye Fire Equipment Company.
    e. Fire End & Croker Corporation.
    f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    h. Larsen's Manufacturing Company.
    i. Moon-American.
    j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
    k. Potter Roemer LLC.
    l. Pyro-Chem; Tyco Safety Products.

2. Valves: Manufacturer's standard.

3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
g. Larsen's Manufacturing Company.
h. Potter Roemer LLC.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Metal lockers.

B. Related Sections include the following:

1. Division 06 Section Rough Carpentry furring, blocking, and shims required for installing metal lockers and concealed within other construction before metal locker installation.

1.3 DEFINITIONS

A. Uncoated Steel Sheet Thicknesses: Indicated as the minimum thicknesses.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Include locker identification system.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For metal lockers, in manufacturer's standard sizes.

E. Qualification Data: For Installer.

F. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal lockers and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:

1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
2. Recessed openings.
3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate size and location of wood bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.
4. Warranty Period for All-Welded Metal Lockers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Basis-of-Design Product: The design for each metal locker specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product approved by architect.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.

B. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

D. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.

E. Plastic Laminate: NEMA LD 3, Grade HGP.

F. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

G. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.3 METAL LOCKERS

A. Available Products:
1. Penco Products, Inc., Subsidiary of Vesper Corporation; Vanguard Lockers.
2. Architectural approved equal.

B. Locker Arrangement: Three tier (1'-0" wide by 1'-0" deep by approx 2'-0" high).

C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.0209 inch (0.55 mm), with single bend at sides.
2. Backs and Sides: 0.0209 inch (0.55 mm) thick, with full-height, double-flanged connections.
3. Shelves: 0.0209 inch (0.55 mm) thick, with double bend at front and single bend at sides and back.

D. Frames: Channel formed; fabricated from 0.0528-inch- (1.35-mm-) thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

E. Doors: One-piece; fabricated from 0.0528-inch- (1.35-mm-) thick, cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges.

1. Doors less than 12 inches (305 mm) wide may be fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.
2. Box lockers less than 15 inches (381 mm) wide may be fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.
3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet; welded to inner face of doors.
5. Door Style: Vented panel as follows:

a. Louvered Vents: Not less than three louver openings at the bottom of each locker.

F. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Hinges: Manufacturer's standard, steel continuous or knuckle type.

G. Projecting Door Handle and Latch: Manufacturer's standard, finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic, prelocking, pry resistant; chromium-plated, vandal-resistant, lift-up handle.
   1. Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

H. Accessories:
   1. Recess Trim: Fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.
   2. Center Dividers: Fabricated from 0.0209-inch- (0.55-mm-) thick, cold-rolled steel sheet.

I. Finish: Baked enamel or powder coat.

   1. Color(s): As selected by Architect from manufacturer's full range.

2.4 LOCKS
   1. To be provided by students.

2.5 FABRICATION

A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.

   1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
   2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.

B. Unit Principle: Fabricate each metal locker with an individual frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch (9 mm) high.

D. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practicable; finished to match lockers.

E. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.6 STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

D. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Metal Lockers: Connect groups of metal lockers together with standard fasteners, with no exposed fasteners on face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

2. Attach recess trim to recessed metal lockers with concealed clips.
3. Attach sloping top units to metal lockers, with closures at exposed ends.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION 105113

SECTION 105500

POSTAL SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Horizontal mailboxes.

B. Related Sections include the following:
   1. Division 1 Section "Sustainable Design Requirements".
   2. Division 6 Section "Architectural Woodwork" for custom enclosures for mailboxes.

1.03 SUBMITTALS

A. General: Submit in accordance with Section 013300.

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of postal specialty.

C. Shop Drawings: For each type of postal specialty. Include plans, elevations, sections, details, and attachments to other work.
   1. Include identification sequence for compartments.

D. Product Certificates: For each type of postal specialty required to comply with USPS regulations, signed by product manufacturer.

E. Qualification Data: For Installer.

F. Maintenance Data: For postal specialties and finishes to include in maintenance manuals.

G. Other Informational Submittals: Final USPS local postmaster approval for installed postal specialties to be served by USPS.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of postal specialty manufacturer for installation of units required for this Project.

B. Source Limitations: Obtain postal specialties through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.

1.06 COORDINATION

A. Coordinate layout and installation of recessed postal specialties with wall construction.

B. Templates: Obtain and distribute to parties involved templates for installing postal specialties.

1.07 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Five years from date of Substantial Completion.

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. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, and as follows:
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Shapes: ASTM B 221.

B. Steel Sheet: Cold rolled, ASTM A 1008, Commercial Steel (CS), Type B.

C. Stainless-Steel Anchor Bolts, Nuts, and Washers: ASTM A 193, Grade B8M, Type 316.

2.03 HORIZONTALXES

A. Rear-Loading, Horizontal Mailboxes: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-

hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door.

1. Products:
   a. Salsbury 4B + 3600 Series (www.mailboxes.com)
   b. Types: 3610 RLP - count of one
      3625 RLP - count of two
   c. Or architectural approved equal

2.04 FABRICATION

A. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs, and safe to touch.

B. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

C. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.

D. Comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.

E. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

F. Fabricate rack ladders to support five mailbox modules to form a column of units.

G. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.

2.05 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish postal specialties after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, roughing-in openings, clearances, and other conditions affecting performance of work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine walls for suitable conditions where recessed units will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install postal specialties level and plumb, according to manufacturer's written instructions and roughing-in drawings.
   1. Metal Protection: Where aluminum will contact grout, concrete, masonry, wood, or dissimilar metals, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.
   2. Final acceptance depends on compliance with USPS requirements.

B. Horizontal Apartment Mailboxes: Install horizontal apartment mailboxes with center of tenant-door lock cylinder not more than 67 inches above finished floor and bottom of lowest compartment not less than 28 inches above finished floor.
   1. Arrange compartments in groups, with not more than 35 and not less than 4 compartments operated by 1 master lock.
   2. Install removable-core door lock cylinders.
   3. Provide two rack ladders for the first column of apartment mailboxes and one rack ladder for each additional adjacent column of apartment mailboxes.

C. Collection Boxes: Install collection boxes with bottom of mail slots not more than 60 inches above finished floor.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of postal specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal specialty manufacturer.

E. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10550

SECTION 11615 - CONTROLLED ENVIRONMENT ROOM

PART 1 GENERAL

1.1. WORK INCLUDED

A. The work under this section of the specification shall include all labor, services, materials, and equipments, and the performance of all work as necessary to furnish and install all prefabricated controlled environment room as indicated on the drawings and as specified.

B. Controlled environmental room shall be furnished complete and ready for installation with all accessories required for installation.

C. The equipment locations, as shown on the plans, shall be checked by the controlled environmental room manufacturer. Exact locations shall be determined by the dimensions of the equipment approved and the layout before apparatus is installed. The manufacturer shall be solely responsible for the accurate installation and correct operational aspects of their equipment and shall correct deficiencies without any recourse to the Owner. Consult the architectural and structural drawings for all dimensions, locations of partitions, locations of pipes and duct work.

D. Manufacturer shall furnish shop drawings for all equipment being furnished and shall also prepare and submit for approval scaled shop drawings representing the actual manner in which the systems and equipment are to be installed. Shop drawings shall show accurately and in detail the dimensions, section, arrangements and elevations of all prefabricated controlled environmental rooms and shall include all measurements, roughing-in diagrams and other necessary details for use by other trades. The manufacturer shall obtain the Owner's Representative's approval for all routing and the foregoing before any materials or equipment are purchases, fabricated, assembled or installed.

E. The controlled environmental room manufacturer shall have a factory trained field service technician on the premises to supervise the installation of all equipment and assist the other trades as to the proper piping rough-in for equipment.

F. A factory trained representative of the equipment manufacturer shall provide one (1) onsite equipment demonstration to Owner.

G. The controlled environmental room manufacturer shall be responsible for providing and field wiring all electrical devices (condensing units, evaporator coils, digital thermometers, alarms, recorders, lighting and above counter electrical receptacles and dehumidifiers inside controlled environmental room.) to multiple junction boxes on the walk-in unless the condenser unit is remote, i.e. not immediately on top of room. If condenser is remote consult electrical drawings for requirements. If heaters are provided they shall be supported with a dedicated line. If applicable, provide separate junction boxes for 3/60/208V, 1/60/208V and 1/60/115V services. Junction box locations shall be coordinated with Owner's Representative and General Contractor.

H. The controlled environmental room manufacturer shall be responsible for all refrigeration hook ups between condensing unit and evaporator and terminating condensate drain line at condensate drain. Location of condenser and routing of condensate drain line to condensate drain shall be coordinated with Owner's Representative and General Contractor. Drain line shall not exceed 10ft, be gravity fed and shall be predetermined prior to initial installation.

I. Manufacturer shall be responsible for blocking in the pre-fabricated partitions to mount adjustable shelves. Coordinate blocking requirements for wall mounted adjustable shelves with the laboratory furniture manufacturer.

J. Delivery and installation of the equipment shall be so performed as to avoid delay to the work of other contractors. The controlled environmental room manufacturer shall be responsible for receiving, uncrating, and setting-in-place this equipment. Refrigeration hook up and condensate drain line to be installed by manufacturer. All internal wiring relevant to the units operation, including light fixtures, are to be supplied and installed by the controlled environmental room manufacturer and terminated at a single point for final connection by relevant trade contractor.

K. The controlled environmental room manufacturer shall coordinate their work with the General contractor and all supporting contractors, providing all information and supervision necessary as required to assure proper and timely installation without delay to the project or other contractors.

L. Manufacturer shall provide appropriate transformers to support their equipment as required based on available voltage in the building.

1.2. RELATED WORK

A. The following labor, services and materials required or incidental to complete the following work shall be provided under other divisions of these specifications.

1. Division 3: Floor slabs; including depressions. Floor depressions must be level, clean and 2" larger then the exterior dimensions of Controlled Environmental Rooms on all sides of depression.

2. Division 9: Walls and ceiling construction enclosing the Controlled Environmental Rooms.

3. Division 15: All ductwork, including supply air register, grills, dampers, diffusers inside rooms, supply ducting to dessicant dehumidifiers and exhaust ductwork from dessicant dehumidifiers and final duct connections when in-room ventilation is specified.

4. Division 15: Condenser water supply, return, condensate drain rough-in piping and condensate drain rough-in piping for dessicant dehumidifier and final connections.

5. Division 15: Provide and install all two-way water-regulating valves as required.

6. Division 15: Provide strainers before and after two-way water regulating valve.

7. Division 15: Service lines to counter top mounted plumbing fixtures including final connections of fixtures.

8. Division 15: Fire suppression systems and devices. Controlled environmental rooms equipment shall have priority over ceiling locations. Coordination of fire suppression systems shall be after controlled environmental room manufacturer has already installed all ceiling mounted controlled environmental room equipment. Sprinkler piping shall not obstruct service access to controlled environmental room equipment.

9. Division 15: Sealing of all penetrations to room structure, inside and outside, with silicone to avoid leakage and condensation.

10. Division 15: Refrigeration equipment supports, adequate pitch pockets in roof and clear pipe chases and / or space for refrigeration and electrical line runs to each room.

11. Division 15: Fireproofing and fire stopping of penetrations.

12. Division 15: Supply intake and exhaust ventilated air to and from all CER. This work will include all duct work, grills, register diffusers and dampers.

13. Division 16: Remote monitoring through DDC system.

14. Division 16: Electrical and data rough-in, disconnects and final connections for all controlled environmental rooms. Disconnects shall be provided within five feet of condensing unit and control panel. Provide proper amperage, phase and voltage within 60" of the control panel and 60" of the condensing unit with disconnects.

1.3. RELATED DOCUMENTS

A. Drawings and general provisions of Contract; including General and Supplementary Conditions and Division Specifications, apply to work of this section.

1.4. QUALIFICATIONS

A. Submit a statement of qualification showing adequate experience in manufacturing equipment of the type and scope called for with a minimum of 10 years experience. The statement of qualification shall also include a list of a least twenty (20) comparable recent installations.

B. Service and Maintenance: Vendor shall be a manufacturer of controlled environmental rooms which maintains factory parts and service. An extended warranty service contract shall be tendered at least one month prior to the end of the warranty periods for consideration by the Owner.

C. Standards: The controlled environmental room design and installation shall conform to applicable codes, ordinances and regulations governing the use and safety of refrigerants, including, but not necessarily limited to the following:

1. ASHRAE/ANSI Standard 15-70, ARI 520-78, ANSIB9.1-1971 and MEMA-70.

2. National Sanitation foundation Testing Laboratory, and Class One Building Type Construction of FM approved standard #4880 for insulated wall construction. Please note batten strips and 6' thru bolts are note required.

3. Approval by Underwriter's Laboratory (UL), labeled and listed, for all components of the Controlled environmental room assembly.

4. Local code approval for panels.

5. Local electrical code approval for doors.

6. Local health, sanitary and safety codes.

D. For panel components and refrigeration, comply with the reduced CFC content regulations mandated as part of the 1989 Montreal Protocol Agreement.

1.5. SUBMITTALS

A. Qualification Data: Prior to executing a contract for the work of this Section, submit qualification data for proposed manufacturer as specified under "Qualification" to demonstrate its capabilities and experience. Include list of completed projects, and other information specified. Include manufacturer's technical data and specifications in sufficient detail for Architect and Owner to assess quality and suitability of products proposed.

B. Deviations: Any deviations from the Specifications, including type of finishes as set forth herein, must be listed in detail, separate from the literature furnished with the bid such that the Architect does not have to expend inordinate time in evaluating competitive bids. In bids, manufacturers should understand that the right is reserved to reject any and all bids. Any bid will rightfully be construed as being based on supplying the design, construction, and materials specified herein.

C. Product Data: Submit manufacturer's technical product data for each item: include installation instructions, roughing-in dimensions, service connection requirements, performance, materials, manufacturer's model number, furnished accessories power/fuel requirements and other similar information.

1. Include documentation indicating compliance with referenced standards.

2. Include copies of manufacturer's standard product warranties.

D. Shop Drawings: Submit shop drawings for controlled environmental rooms, showing floor and ceiling plans, elevations, cross-sections, service run spaces; details and location of anchorage's and fitting to floors, walls and ceiling; details of features and furnishings within room; control panel design; sensor location; layout of units with relationship to surrounding walls, doors, lighting and ventilation fixtures, and other building components.

1. Include on the drawing, the performance requirements for each room.

2. Include service connection information for other trades.

3. The manufacturer/installer shall obtain the Architect/engineer's approval for all routing and the foregoing before any materials or equipment are purchases, fabricated, assembled or installed.

E. Samples. Submit the following material, finish and color samples:

1. Insulated wall panel with exterior and interior finish.

2. Insulated floor panel with exterior and interior finish.

3. Finish flooring material.

4. Adjustable shelf (36" x 14").

F. Operation and Maintenance Manual: Include instructions for sequential operation, start-up and shut down, with pertinent control data and schematics, room arrangement, and recommended maintenance of equipment. At completion of work, submit one copy of 3-ring binder containing: "as-built" drawings, product data and operation and maintenance information listed above. After Architect's acceptance is received, submit 4 copies for Owner's use.

G. Certificates. Submit certified statement by issuing agencies that manufacturer has been issued the following certificates:

1. CFC Compliance. Insulated panels shall comply with current EPA Regulations and the Clean Air Act. Manufacturer shall supply Notarized Affidavit that the insulated panels are a Class I foam type that conforms to current statutes in effect at date of job site arrival. CFC emission compliance foam type must be Factory Mutual Standard 4880, including full scale corner test; UL E-84; New York City MEA, the New York toxicity standard. The affidavit shall hold harmless and indemnify the owner, the architect, the engineer and the equipment consultant from any fines, summons or liabilities which may result from a violation.

2. EPA Venting Issue. The manufacturer shall submit a certificate that one (1) job site mechanic has received accredited training conforming to the EPA and Clean-Air Act of July 1, 1992. Any sub-manufacturer and/or general refrigeration manufacturer shall assume full responsibility for the actions of the employees or casual helpers in respect to "venting" of EPA regulated refrigerant gases. Furthermore, manufacturer will supply an affidavit which specifically indemnifies and holds harmless the owner, the architect, the engineer and the equipment consultant from any fines, summonses or liabilities which may result from "Venting Controlled Refrigerants".

H. No portion of the work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Owner's Representative. All such portions of the work shall be in accordance with approved shop drawings and samples.

1. Material Safety Data Sheets (MSDS) for all adhesives, sealants, and paints. If the MSDS does not show the product's Volatile Organic Compound (VOC) content, this information shall be provided through other published product literature from

the manufacturer or stated in a letter of certification, on the manufacturer's letterhead, from the product.

1.6. FIELD MEASUREMENTS

A. The controlled environmental room manufacturer is responsible for physically measuring the area to assure that their equipment will fit in the designated location. Any dimensional corrections will be accomplished at no change in contract sum.

1.7. WARRANTY

A. Submit warranty signed by Manufacturer and countersigned by Contractor, agreeing to replace/repair/restore defective equipment, components, materials and workmanship of work during the periods indicated for each item from date of Owner's acceptance. "Defective" is hereby defined to include, but not by way of limitation, operation or control system failures, performance below required standards, excessive wear, unusual deterioration or aging of materials of finishes, the need for excessive maintenance, and similar unusual, unexpected and unsatisfactory conditions. Prominently display in each room the name of install/service agency to be contracted during warranty period.

1. Compressor units: five (5) years.

2. Panels or room construction: fifteen (15) years.

1.8. DEFINITION OF CONTROLLED ENVIRONMENTAL ROOM ASSEMBLY CRITERIA

A. Cold / Warm controlled environmental room is a laboratory: is an enclosed space that maintains temperature control sensitivity at +/- 1°C. This room requires ventilation because it can be occupied space.

PART 2 PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS

A. Insulated Structures Corporation-PB Group (Chestnut Ridge, NY)

B. Environmental Growth Chambers, (Chagrin, Ohio)

C. Environmental Specialties, Inc. (Raleigh, NC)

2.2. INSULATION

A. Insulation shall be rigid urethane foam poured-in-place, not frothed. Overall thickness shall be 4"minus metal skins.

B. All construction shall conform to the requirements of the National Sanitation Foundation Testing Laboratory, Underwriters Laboratories, and Class One Building Type construction of Factory Mutual approval standard #4880 for insulated wall construction and shall be conspicuously labeled on each component and listed on Controlled environmental rooms. It shall conform to ASTM Fire Hazard Materials test Numbers E8461 and E16267, and have a low flame spread rating of 25 or less for a 10 minute time period. Controlled environmental room manufacturer shall supply with their bid a

certified statement by issuing agencies that the controlled environmental room manufacturer has been issued certificates that certify compliance.

C. All panel components shall conform to the reduced CFC content regulations mandated as part of the Montreal Protocol and shall bear a label conspicuously affixed to each component part.

D. Panels shall conform to the requirements of the locally recognized building code.

2.3. WALL AND CEILING CONSTRUCTION

A. Controlled environmental rooms shall be prefabricated, all metal clad, sectionally constructed and designed for easy and accurate field assembly. Sections shall be made without structural members with 100% of each section, exclusive of metal skins, being urethane insulation. Section edges must have tongue and grooves foamed-in-place with foamed-in-place gaskets on each edge to assure airtight joints.

B. Sections shall be made of 11-1/2", 23", 34-1/2" and 46" widths and to be interchangeable for fast, easy assembly. Sections shall be made without internal wood or metal structural members with 100% of each section, exclusive of metal skins, being urethane insulation. Section edges must have tongue and groves foamed-in-place with gaskets on each edge to assure airtight joints. Other panel widths may be required to assure the desired dimensions specified. All other panel sizes shall be considered custom sizes.

C. Panel wall sections shall be assembled with double strapped cam locks. Distance between locks shall not exceed 46". At least three locks shall be used for all vertical joints. Joining devices shall be rigidly connected from one joining edge to the other joining edge of the same section by use of (2) 1-1/4" steel straps set into the insulation, forming perimeters of steel for extra strength.

D. To assure perfect alignment and maximum strength, 90 degree angled panels shall be provided for each corner. The exterior horizontal dimension of each side of this corner shall be 12".

E. Panel wall sections shall be constructed to attain an overall unit height of 9'-3½".

2.4. FLOOR CONSTRUCTION

A. Floor sections shall be similar to all other sections but shall be made to withstand uniformly distributed floor loads. Load bearing shall be 600 psf for a 2" thick floor utilizing a 14 Gauge galvanized steel interior surface.

2.5. FLOOR COVERING

A. All Controlled environmental room floors shall be covered with a crevice-free, non-absorbent, slip-resistant, abrasive vinyl (90% virgin vinyl matrix) floor covering equal to Walkway 20 manufacture by Altro Corporation, San Francisco, CA. Material shall have temperature stability, dimensional stability and flexibility from +60°C. to -20°C. Flooring shall be smooth, free of ribs or patterns. Flooring shall require no maintenance except cleaning with detergent and water. Depending upon room size, floors shall be seamless or seams shall be welded. Floor covering shall be coved up the walls 4" high, capped with a vinyl trim piece and continuously silicone sealed between vinyl cap and

walls. Floor covering color shall be selected by Architect from manufacturer's standard colors.

2.6. EXTERIOR AND INTERIOR METAL SKIN FINISH

A. Smooth white galvanized steel exterior

B. Smooth white galvanized steel interior

2.7. STANDARD HINGED ENTRANCE DOORS

A. Entrance openings shall be provided in 46" sections. The door shall be an in-fitting flush mounted type. Construction of door frame to be as stated in paragraph on wall construction. It shall have a "U" channel type, reinforced stainless steel frame of not less than 12 Gauge thickness around entire perimeter of the door opening to prevent racking and twisting. Sill plates shall include safety walk strips. Door to be capable of reversing swing, left or right, in the field.

B. Opening size: 36" wide x 77" high.

C. All hardware shall be made of satin finish aluminum.

D. Each door shall have three (3) hinges, self-closing and spring loaded type with stainless steel pin and Delrin cam type bearing and positive action hydraulic type door closer. Door exterior shall have a "break-away" type latch handle and a push plate on the interior.

E. External cylinder type lock. Coordinate cylinder and key with Owner's representative to match project. It shall include an inside safety release handle to prevent anyone from being locked inside.

F. A thermoplastic gasket with magnetic steel core shall be mounted on top edge and along both sides of the door. The bottom of the door shall contain a wiper gasket.

G. Each door frame shall have (1) heater to prevent condensation and frost formation. Heater shall be concealed and around the entire door perimeter. Heater and element shall be minimum 300 watts.

H. All door panels shall conform to locally recognized electrical and building code.

I. Vision Panel. A nominal 14" wide x 23" high vision panel shall be provided in all doors. It will consist of three panes of glass with sealed air spaces between them. The window shall be supplied with (1) heater and shall be removable for replacement.

J. Light switch with pilot light mounted on the outside of unit.

2.8. DIGITAL THERMOMETERS DISPLAY

A. Provide surface mounted displays with a range of -40°F to +100°F (-4.4°C – 37.7°C). Thermometer shall be capable of displaying temperature in degrees Fahrenheit or degrees Celsius, as designated by the user. Thermometer probes shall be long enough to extend from display to inlet air of blower coil, armor sheathed. Provide one (1) thermometer for each walk-in compartment and locate on control panel.

2.9. CEILING

A. Controlled environmental rooms require the following construction criteria to accommodate the control requirements:

1. Ceiling Plenum: Provide uniform air circulation and distribution system throughout controlled environmental room utilizing a plenum ceiling. Plenum shall also house lighting fixtures, make-up air fan, refrigeration devices, etc. Clearance below finish ceiling plenum within room work area shall be unobstructed. Include supply and exhaust duct collars above ceiling sized and located as required by HVAC trade.

2. Ceiling Materials: Provide an "egg crate" type white plastic panel 1/2" thick that has 1/2" x 1/2" holes covering 90% of the surface area of the panel.

2.10. LIGHTING

A. Fluorescent lighting fixtures, gasketed and vapor-proof, with door mounted acrylic lenses in sufficient quantity to provide 70-80 fc at 36" AFF. Provide ballast's rated as cold temperature, high efficiency. All fixtures shall be Underwriter's Laboratories approved and rated to operate at temperatures as low as -20°C.

B. All lighting fixtures to be high output low temperature ballast, moisture proof type units.

2.11. CLOSURES

A. Closure strips of materials matching the exposed exterior of the controlled environmental room shall be furnished and installed wherever a space exists between the walls and roof of the walk-in and other walls, columns, ceilings or ledges.

2.12. ELECTRICAL FITTINGS

A. Provide recessed, GFI, vapor-proof, 115 Volt duplex electrical outlets as shown on room elevation drawings and mounted 45" A.F.F. Electrical outlets shall be wired through the control panel. The 2" x 4" junction box for each outlet shall be foamed into the insulated panel with EMT conduit from the junction box and extended to the top of the room to allow for electrical connection of the outlet. All conduit shall be hidden within the walls of the room. All wiring and conduit from the outlet to the controlled environmental room's central junction box shall be provided by the controlled environmental room vendor and must comply with local code. The wire size shall determine the diameter of the conduit.

2.13. CONTROL PANEL

A. Provide split control panel assembly that is an integral operating system in accordance with UL508A, and bear UL508A labeling.

B. Assembly is a split component system consisting of two inter-linked items:

1. Full Color Touch Screen Display surface mounted on exterior wall of room adjacent to doorway and at 48" AFF and include the following:

a. Operate at a maximum of 24 volts.
b. Contain all control functions to adjust temperature set points.
c. Alarm functions are carried with all changes in temperature set-points.
d. Contain the graphically illustrated chart readings in linear "chart form".
e. Serve as the data recorder and that shall record and store internal history data based on time speed. Data will be compatible with owners PC computers, allowing owner to download and print archive data as needed.
f. Shall include the following functions:
   1) Refrigeration on/off.
   2) Temperature readout.
   3) High/Low Temperature Alarm readout.
   4) Defrost on/off.

2. CPU sub-unit shall be mounted in a non-visible on the exterior top of the room close to the front of the entry door. Access to unit must be provided. It shall have the following:

   a. Inter-linked to touch screen via a hidden low voltage "umbilical" cord of inter-wiring within the insulated wall panel.
   b. Contain line voltage, or high voltage routing as may be required for proper function of the room's temperature operating parameters.
   c. Defrost timers.

3. Manufacturer shall provide a schematic-wiring diagram all wiring requirements. They will be responsible for any internal room wiring up to CPU unit.

4. Unit shall be manufactured by Automation Direct Corporation or approved equal.

2.14. ROOM TEMPERATURE UNIFORMITY

A. Control set-point shall be as specified in the Schedule of Rooms. Temperature uniformity shall be +/-1.0°C as measured on a multi-point recorder using a minimum of twelve (12) sensors distributed throughout the chamber 40" AFF and 12" from walls.

2.15. PRE-ASSEMBLED REFRIGERATION SYSTEM

A. General

1. Pre-assembled refrigeration systems consist of two major assemblies. One is the condensing unit assembly with all necessary components, factory installed and wired, including electrical box, time clock, drier sight glass and all necessary interconnecting tubing and wiring. The other is the evaporator coil assembly with expansion valve, fan(s) and heat exchanger completely factory mounted.

2. The refrigeration system shall be integral part of the control and conditioning system. Each system shall be designed and furnished to operate continuously. The defrost feature shall include a timer with fan delay switch. The room's temperature rise during defrost cycle shall not exceed 5°C above set point. The defrost period shall be adjustable but not to exceed twenty minutes.

3. System shall be designed to operate with R-134A refrigerant for all units.

4. Semi-hermetic compressor shall be furnished for air–cooled, indoor operation. Compressor shall be installed remotely in the mechanical attic with access for service.

5. Compressor-condensing unit shall be specifically designed, engineered, manufactured and of adequate capacities to achieve and maintain the individual room operating temperature requirements and performance and shall be balanced in operation with conditioning system. Compressor-condensing unit shall be complete in all respects and shall include high/low pressure control, receiver, sight glass, drier, expansion valves and all necessary equipment to achieve the performance specified.

6. Where noted as such, the unit shall be sized mechanically to compensate for ducted ventilation supplied by the building central system. Unit shall be equipped with appropriate registers for supply and exhaust of this air.

7. The unit shall be equipped with an adjustable head pressure, two way automatic adjustable water recirculating valve.

8. The name of the condenser/refrigerant manufacturer must be submitted at time of submittal.

B. Condensing Units

1. Shall be provided complete with motor, air cooled condenser, receiver, compressor and all other necessary components mounted in a flexible manner on a common base with vibration isolation equal to Mason Industries SLRS. Compressor shall be semi-hermetic type and shall be designed for continuous operation at the specified evaporating temperature in a 105°F (40°C) ambient temperature. Motor starters and safety disconnects are required, they shall be furnished for installation in an electrical control panel enclosure. Unit shall operate with central process/chilled water service at 47°F.

2. Pre-assembled system controls shall be supplied pre-wired. Fractional through two horsepower systems shall be connected directly to the compressor contactor. For three horsepower systems and higher disconnect switches shall be supplied. On medium temperature systems a solenoid valve shall be supplied so wiring between evaporator and condensing unit is not necessary.

3. The condenser shall be wired to a dedicated circuit and operate on 3/60/208V service.

C. Evaporators

1. Shall be force-convection, unit cooler type, made to be suspended from the ceiling sections. They shall be complete with forced air circulation, arranged so that cooled air is discharged parallel to the ceiling. Air circulating motor, multi-fin and tube type coil and grill (required for safety) shall all be assembled within a protective housing. The coil shall be copper tube, aluminum fin design with aluminum housing; minimum four rows deep. The expansion valve, with

strainer, heat exchanger, and inlet/outlet connections shall also be contained within this housing. The coil fan motor shall be a minimum 1/6 H.P. ball-bearing design, rubber mounted; minimum 14" diameter heavy duty aluminum fan blade. Air velocity shall be less than 500 fpm. Air circulation motors must be lifetime sealed and the entire unit cooler assembly must be readily accessible for cleaning. If forced air ventilation is specified, unit's coils shall be size appropriately to accommodate the additional heat load and a defrost mechanism be incorporate to avoid freezing.

2. A drip pan, drain connection and drain line shall be provided. Unit evaporators shall be equipped with mounting brackets for installation and all controls necessary for safe and satisfactory operation. When the Controlled environmental room is used for freezing, an automatic system for defrosting the unit's evaporator, including heaters and time control, shall be supplied. Each refrigerant system shall include a dehydrator, liquid line sight glass, shut-off valve, liquid-line solenoid, thermostatic expansion valve at each evaporator, vibration isolator, and other fittings and accessories, as required. Refrigerant lines shall extend vertically from condensing unit to above the hung ceiling, then horizontally to above the evaporators, then in accordance with manufacturer's recommendations.

3. The entire system shall be cleaned, pressure tested, dehydrated, and separately vacuum tested each time for a period of five hours. The pressure test is to be at least 100 PSI above operating conditions and vacuum at 28.5" of mercury or less. The required operating charge of refrigerant and oil shall then be added and the system tested for performance.

4. Condensate lines shall be routed out of the box and terminated at condensate drains. Drain Piping: 7/8" O.D., or greater, Type L copper tubing piped from evaporators to open floor drain, rigidly supported at walls 3' O.C. maximum. Adequately pitch piping toward floor drain, carry through wall of refrigerated areas properly trapped and discharged within 2" of floor drain. Provide chrome-plated escutcheons on both sides of wall penetrations. In the even condensate drain termination cannot be achieved by gravity, provide condensate pump.

D. Piping.

1. General: All refrigerant piping shall be refrigeration grade, either hard or soft-drawn (as required by design) seamless copper tubing, with high-temperature silver solder, Stay-brite or approved equal, joints. All refrigerant suction lines outside of rooms shall be insulated with 1/2" insulation equal to Armstrong Armaflex applied during tubing assembly wherever possible and in accordance with the manufacturer's recommendation.

2. Specific Requirements: Manufacturer shall size refrigeration piping integral to equipment.

2.16. DEHUMIDIFICATION TO DRY CFM INTAKE AIR

A. The controlled environmental room manufacturer shall, as required to maintain the specified room conditions, supply a dehumidifier with the following characteristics.

1. Dehumidifiers are to be constructed as follows: All air plenums are constructed of hardened aluminum sheet which is welded, gasketed and/or sealed to be air and vapor tight at design static pressures and air flows. Process air inlet plenum is insulated with 1" insulation as required to minimize external condensation. Access panels are to be labeled and furnished with resilient gaskets to preserve the air and vapor integrity. The control enclosure is to be included as standard, mounted within the unit housing is a printed circuit board with a control-indicating package. The feature is to include three push button switches with indicating lights for Auto, Off and Manual Operation, a high process Air Volume Warning Light and a Red Fault Light. The Fault Circuitry is actuated by loss of either Blower Operation or by an Overheat Condition. All power and Control Wiring is in conformance with National Electric Code.

2. A small desiccant dehumidifier is to be placed on top of the cold room. The desiccant dehumidifier is to be provided by the cold/environmental room manufacturer. Division 15 (HVAC) is to run the CFM intake air duct into the desiccant dehumidifier to dry the air. Division 15 is also to run duct from processed dry air port from the desiccant dehumidifier to the cold/environmental room in order for the dry processed 50 CFM intake air to enter the cold/environmental room. Division 15 is to supply a hard line duct with insulation on the dry processed CFM intake air duct before entering the cold/environmental room. The power supply for this desiccant dehumidifier shall be run through the cold/environmental room manufacturers control panel. Division 15 (Plumber is to provide a condensate drain line for the desiccant dehumidifier.

2.17. VENTILATION

A. General.

1. Once all ducts and pipes are installed, the cutouts shall be silicone sealed both outside and inside the box to avoid leakage and condensation. This shall be executed under Div. 15.

2.18. SCHEDULE OF ROOMS

A. General.

1. All utility requirements noted in the Schedule of Rooms exclude lighting, occupancy, laboratory equipment loads and the additional power required for intermittent defrost heater when the compressor shuts down. They are included merely as a guide to assist the project engineer in the equipment evaluation of the central plant and to the equipment manufacturer to assist in their bid preparation. Once the contract is awarded, the Controlled environmental room manufacturer will determine the specific utility requirements for each unit. They will engineer and provide the properly sized equipment to the job to fulfill their contractual obligations. The room manufacturer shall calculate and compensate for all internal heat loads when sizing the refrigeration system, including, but not limited to, the following:

a. Lighting

b. Laboratory equipment loads (assume 4 watts/SF)
c. Integral door and window heaters
d. Evaporator
e. Ventilation where indicated (assume .5 CFM per square foot of room, 50°-72°F, 30-95% RH)
f. Defrost heater if below 3°C
g. Head load for Dehumidifier
h. Occupancy (assume 1 person for up to 2 hrs/day).

2. Electrical loads for condenser units shall be 3/60/208V. All other electrical loads (evaporator, dehumidifier, door heater, window heaters, lights, alarms, chart recorders, etc.) shall be 1/60/120V and shall be run through the control panel.

B. Schedule of Rooms:

1. Equipment Designation: CR1

a.	Exterior Dimensions:	9'-8" x 9'-8" x 9'-3½" high.
b.	Interior Dimensions:	9'-0" x 9'-0" x 8'-9½"high
c.	Minimum Pit Dimensions:	9'-10" x 9'-10" x 2" deep
d.	Temperature (°C):	+4°C +/-1°C
e.	Ventilation:	Yes
f.	Electrical Load	
	1) Condensing unit:	3/60/208V, 25A circuit
	2) Evaporator:	Wired thru Control Panel
	3) Control Panel:	208V, Neutral 60A, 4-wire, Full Load Amps
	4) Dehumidifier:	Wired thru Control Panel
	5) Condenser (HP):	2
	6) Condenser Water (GPM@85°F):	10

g. Comments:
1) Pit mounted, provide integral floor.
2) Door heater, window heaters, lights, alarms, etc. shall all be powered from the control panel circuit.

PART 3 EXECUTION

3.1. GENERAL

A. All units that are specified with temperature control with a precision of at least +/- 1.0°C must be assembled in the factory and tested to demonstrate this capability. The results of the test will be sent to the Owner's Representative for his review and approval. Only after this approval is given may the manufacturer break down the unit and ship it to the job site for installation. The Owner's Representative reserves the right to be present when the test is done. All costs associated with this test, including but not limited to the inspection team's travel expenses (assume one person), are part of this section of the specification. All other units to be field tested.

3.2. EXAMINATION

1. Examine and verify areas and work of other trades for the following:

   a. Correct dimensions.
   b. Properly located electrical services.

2. Report any unsatisfactory field condition to the Contractor in writing. Do not proceed with installations until unsatisfactory conditions have been corrected and conform to project requirements.

3.3. PREPARATION

A. Scheduling and Coordination: The room installer shall examine project conditions at the site with regard to access, dimensions, conditions as they exist and the general areas of work, and shall perform work in such a manner as required to deliver, install and connect the rooms in close coordination with work of other trades.

3.4. INSTALLATION

A. Install controlled environment rooms in accordance with manufacturer's recommendations and final approved shop drawings

1. Install components straight, plumb, level and true. Install service lines at right angles to walls and floors, except where required to pitch to drains.

2. Seal or otherwise insure that fastenings to rooms do not compromise vapor barriers or insulation. Seal between all piping, conduit and sleeves.

B. Pressurize and leak test entire system at not less than 100 psig, clean and dehydrate by maintaining a vacuum of 50 microns, or lower, for a 5 hour period. Add required charge or refrigerant, and oil if necessary, and test entire system for performance. Mark each system clearly as to refrigerant type used.

C. Provide filler panels to enclose spaces between tops of rooms and ceiling of surrounding area. Extend filler panels to underside of construction above if necessary.

3.5. PERFORMANCE TESTING

A. General: Provide equipment for testing and perform tests. Tests shall confirm that rooms conform to the following requirements:

1. Temperature control of +/-1.0°C in controlled environmental rooms shall be temperature at the sensor and shall be the total variation in the temperature control of the room. It should not be confused with temperature uniformity as noted below.

2. Temperature uniformity of +/-1.0°C refers to the maximum allowable variation in temperature as measured on a horizontal plane 40" AFF and within 12" of walls throughout the entire room. Uniformity shall be measured by a multipoint strip chart recorder utilizing a minimum of 12 thermo-couples during a

continuous 12-hour test period. Gradient from floor to ceiling shall not be more than 2°C.

3. Room shall recover preset operating temperature within 5 minutes after door has been fully opened to 75°F (24°C) ambient temperature for a period of 1 full minute. Repeat door opening operation, as described, 3 times during the 12-hour period, at least 1 hour apart.

4. After completion of installation each room shall be tested for a minimum of 12-hour at extremes of temperature specified in Schedule of Rooms. Rooms specified to operate over a range of temperatures shall be tested for 12-hour at each of two set points (to be determined) with the second test at the set point designated for operation at acceptance of the unit.

B. Owner's representatives shall be given the option of witnessing and confirming test results. Notify Owner's representative in writing, prior to test.

3.6. CLEANING AND PROTECTION

A. Repair or remove and replace defective work, equipment and accessories as directed upon completion of installation.

B. Clean exposed and semi-exposed surfaces, touch-up finish as required. Remove and refinish damaged or soiled areas.

C. Protection: Adequately protect the work from damage until final acceptance by the Owner.

END OF SECTION 11615

SECTION 11710 - LABORATORY EQUIPMENT

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division Specifications, apply to work of this section.

1.2. WORK INCLUDED

A. Furnish all labor, materials, tools, equipment and services for all equipment as indicated in accord with provisions of Contract Documents. Completely coordinate with work of all other trades.

B. Although such work is not specifically shown or specified, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

C. Equipment in this section is listed below.

Sect	Equipment Description
2.1	BD: Bedding Dispenser
2.2	BF: Bottle Filler
2.3	CRW: Cage & Rack Washer
2.4	DW: Undercounter Dishwasher
2.5	FUM6: Chemical Fume Hood
2.6	ICE: Ice Flaker
2.7	LST: Large Steam Sterilizer – chamber size 48" x 84" x 84"
2.8	ST1: Steam Sterilizer – chamber size 26"x26"x38"
2.9	BSC6PT: Biological Safety Cabinet Pass-Through
2.10	BDS: Bedding Disposal System
2.11	BSC/B1: Biological Safety Cabinet Class II/Type B1
2.12	D: Dryer
2.13	W: Washer
2.14	MW: Modular Wall
2.15	LAM6: Laminar Flow Workstation-Vertical
2.16	LAM6: Laminar Flow Workstation-Horizontal

1.3. RELATED WORK

A. Relevant trade contractors will provide rough openings, pits, substrate preparation and blocking for all equipment installations.

B. Mechanical contractor will provide exhaust rough-ins and final connections for all equipment installations.

C. Plumbing contractor will provide supply/return service line, drain and vent rough-ins and final connections for all equipment installations.

D. Electrical contractor will provide electrical service rough-ins and final connections for all equipment installations.

1.4. QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this section.

B. Dimensions, voltages, electrical power requirements, and utility connections are based on the items specified. Relevant trade contractor is responsible for all costs associated with service or dimensional adjustments.

C. Equipment may be inspected by Owner at manufacturer's plant prior to shipment. Equipment found not in accord with specifications and approved drawings may be rejected. Replace rejected equipment at no cost to Owner. Provide Owner's Representative two (2) week prior notice to all factory testing.

D. Electric operated and/or heated equipment shall comply with applicable standards of National Electrical Manufacturer's Association (NEMA), National Electric Code (NEC) and Underwriters' Laboratories, Inc. (UL) or Electrical Testing Lab (ETL).

E. Manufacturer Qualifications: Manufacturer shall be a firm having an established organization and factory, with production facilities specializing in the type of equipment specified, having an experienced engineering department and an established history of similar installations of equal scope and complexity. Manufacturer shall have the demonstrated ability to produce the specified equipment of the required quality and a proven capacity to complete an installation of this size and type within the required time limits. Service response time to a telephone inquiry shall be same day (or within 4 hours, whichever is less) followed up by a factory trained technician at the site within 24 hours of the telephone inquiry; all serviceable components warehoused or readily available to service personnel; and fast access to shop drawings of all equipment in field.

F. Acceptable Manufacturers: Each piece of equipment listed includes the manufacturer's name and catalog number, establishing levels of quality, specific construction features, operating conditions and desired features and accessories. By indicating other manufacturer's names does not relieve perspective bidders of their obligation to prove that their submissions are equal to specified equipment in size, construction, performance, basic features, options and accessories prior to award.

G. Installer Qualifications: Manufacturer, or approved in writing by manufacturer.

1.5. SUBMITTALS

A. Specification Compliance. Submit copy of relevant item specification section (from this document) and clearly note in bold print any substitutions, modifications or objections.

B. Product Data. Submit manufacturer's specifications and installation instructions for each item of laboratory equipment furnished. Indicate on product data which optional devices and operations are proposed for inclusion with equipment. Where substitutions for specified items of laboratory equipment are proposed, submit data substantiating the proposed equipment is equal to that specified. Manufacturer's specifications must

contain a full, detailed explanation of all variations in operating and/or performance requirements.

C. Shop Drawings. In addition to work shown on manufacturer's printed product data, submit dimensional roughing-in drawing, at minimum scale of 1/2" = 1'-0", showing equipment placed in actual project site conditions adjacent to other equipment and relationship to the work of other trades, as well as mechanical and electrical requirements. Rough-in drawings shall clearly indicate where equipment connection varies from relevant trade contractor supply source. Submit dimensioned fabrication drawings for custom fabricated equipment, including plans, elevations, and sections, at minimum scale of 3/4" = 1'-0", showing materials and Gauges used.

D. Samples. Submit samples of exposed finishes when requested by Architect.

E. Operational and Maintenance Data. Submit operating and maintenance instructions and parts listing for each item of fixed laboratory equipment. Include this data, product data, shop drawings, wiring diagrams, and any other data required by Owner, in three-ring maintenance manual. Prepare draft copy of operation and maintenance manual for Owner's review. Submit four (4) copies of final, accepted manual for Owner's use.

F. Manufacturer's Qualifications. Letter confirming required minimum experience, references and service response time.

G. Applicable standards approval from NEMA, NEC, UL, ETL or as specified with the individual equipment items.

1.6. DELIVERY, STORAGE, HANDLING AND INSTALLATION REQUIREMENTS

A. All equipment in this specification shall be Contractor Furnished/Contractor Installed (CFCI). Certain equipment items will include Manufacturer Assembly (MA), Manufacturer's Assembly Supervision (MAS), Manufacturer's Installation Supervision (MIS) or Manufacturer's Equipment Demonstration (MED). MIS includes MED.

B. Contractor Furnished/Contractor Installed (CFCI): General Contractor and/or relevant trade contractor (both identified as the "Contractor) to purchase, receive, unload, store, unpack, re-assemble, set-in-place, install and clean up equipment. Deliver to site in manufacturer's original labeled containers. Contractor to provide any fasteners, supports or other miscellaneous items necessary for complete installation. All rough-ins and final connections by contractor. Contractor to use all means necessary to protect materials of this section before, during and after installation and to protect installed work and materials of all other trades. Contractor to confirm in writing that installed equipment meets or exceeds manufacturer's specifications. Contractor to provide owner's representative with rough-in and installation drawings of installed equipment. Where specified (MIS or MED), contractor will coordinate with manufacturer installation supervision and/or on-site equipment demonstrations. Scheduling of on-site equipment demonstrations to be at the convenience of the Owner.

C. Manufacturer Assembly (MA): Manufacturer will provide adequate assembly personnel for as long as it takes to complete installation to satisfaction of owner's representative. Manufacturer's field supervision personnel may or may not be union depending on conditions of site. If schedule demands it, manufacturer will agree to have their field assembly personnel work overtime at no additional cost. Manufacturer assembly and MED included in equipment price.

D. Manufacturer's Assembly Supervision (MAS): Manufacturer will provide adequate assembly supervision personnel for as long as it takes to complete installation to satisfaction of owner's representative. Manufacturer's field supervision personnel may or may not be union depending on conditions of site. If schedule demands it, manufacturer will agree to have their field supervision personnel work overtime at no additional cost. Manufacturer assembly supervision included in equipment price and provide following:

1. Trip(s) to job site to coordinate specific technical project requirements.
2. Trip(s) to job site to instruct equipment assembly and installation crews.
3. Trip(s) to job site to check final assembly and installation, trouble-shoot and start-up equipment.
4. One (1) one-day trip to job site to instruct Owner on proper operation and maintenance of equipment. Scheduling of on-site equipment demonstration to be at convenience of Owner.

E. Manufacturer's Installation Supervision (MIS): Where noted in the specifications (i.e.: MIS), the manufacturer shall provide adequate installation supervision personnel for as long as it takes to complete the installation to the satisfaction of the owner's representative. Manufacturer's field supervision personnel may or may not be union depending on the conditions of the site. If the schedule demands it, manufacturer to agree to have their field supervision personnel work overtime at no additional cost. Manufacturer installation supervision shall be included in equipment price and provide the following:

1. Trip(s) to the job site to coordinate specific technical project requirements.
2. Trip(s) to the job site to instruct equipment installation crews.
3. Trip(s) to the job site to check final installation, trouble-shoot and start-up equipment.
4. One (1) one-day trip to the job site to instruct Owner on proper operation and maintenance of the equipment. Scheduling of on-site equipment demonstration to be at the convenience of the Owner.
5. Manufacturer's Equipment Demonstration (MED). Where noted in the specifications (i.e.: MED), the manufacturer shall provide one (1) one-day trip to the job site to instruct Owner on proper operation and maintenance of the equipment. Cost of this service shall be included in equipment price. Scheduling of on-site equipment demonstration to be at the convenience of the Owner.

1.7. WARRANTY

A. Except where more stringent warranty requirements are noted in the individual equipment descriptions, all equipment furnished under this section to be guaranteed for a minimum of one (1) year, parts and labor, from date of substantial completion against defective materials, design and workmanship. Defects shall be promptly rectified at vendor's expense after notification by Architect.

1.8. JOB CONDITIONS

A. Drawings show arrangement and location of items of equipment. If it is necessary to vary from arrangement shown, because of structural, mechanical, electrical or other considerations, make such variations only after approval of Architect and at no additional cost to the Owner.

B. Verify all dimensions at building. Confirm that all equipment will be able to be moved through the building in order to reach its designated location. Measure all recesses and openings at building and provide all trim pieces, fillers and closures in sizes required.

C. Condensate will not be returned. Provide integral condensate cool-down system prior to discharge to building drains.

D. If autoclaves are connected to either potable or RGW water source requiring their own steam generators, they shall be designed and constructed to allow for "in-place" acid de-scaling and flushing operation.

PART 2 PRODUCTS

2.1. BD: BEDDING DISPENSER

A. Product Description.

1. Application: Semi-automatic unit designed to dispense bedding into animal cages simultaneously when they are placed into position within the filling area. Dispenser capable of handling all solid bedding as currently used in care of laboratory animals. The dispensed bedding volume shall be adjustable to accommodate various depths and sizes of cages.

2. Size:

a. Filling Area Height: 33"
b. Hopper Capacity: 15 cubic feet minimum.
c. Overall machine: 43"W x 93"H x 34"D.

3. Operation:

a. Storage-dispensing hopper is manually filled by animal care staff.
b. To dispense bedding, rodent cages shall be placed in the filling area. The operator shall depress the appropriate button on the operator panel dispensing a preset amount of bedding material, in a continuous sheet. Sheet shall extend the full width of the filling area. Cages can placed in the filling area in any random pattern and will be filled with same amount of bedding per square inch of cage bottom. Rate at which bedding is dispensed is adjustable, so amount of bedding deposited in cages can be varied. Bedding that falls outside cages will fall through wire grille and into bottom loading hopper.

4. Construction:

a. Storage-dispensing hopper and filling area shall be 14 Gauge stainless steel. All structural supports stainless steel. All sprockets, shafts and chains carbon steel. Unit supported on four adjustable legs to level unit and set conveyor height.
b. Controls include a start-stop switch.
c. A hinged cover installed on loading hopper. Service access doors shall be located on the top and sides of the dispenser.

d. A clean-out door located on front face of dispenser for easy access to lower hopper. Ship disassembled for entry into building with uncrated sections able to pass through a 3'-6" x 6'-8" doorway.
e. Unit shall include integral dust filtration and dust collection systems and all necessary filters.

5. Utility Requirements:

a. E1 1/60/120V, 30 Amp.
b. EXH 4" ID Duct, 650 CFM, 3/4" static pressure.
c. A 1/2" NPT, building compressed air system, 6 CFM.

B. Equipment item(s) shall be CFCI with MIS.

C. Unit(s) shall be equal to Lynx Product Group Model: 710LX Bedding Dispenser. Unit(s) manufactured by Steris or TBJ shall be considered equal, provided they meet the requirements of this specification.

2.2. BF: BOTTLE FILLER

A. Product Description.

1. Application: Feeder bottle filler is a manifold type filler designed for filling basket loads of feeder bottles used in the care of laboratory animals.
2. Size:

a. Basket: 17" x 17"x 12" H; 5x5 configuration. Vendor to confirm with Owner appropriate basket size and configuration without change in contract cost.
b. Bottles: 8 oz or 16 oz capacity.
c. Load Height: 25" AFF.

3. Operation: Operator places baskets of clean bottles on the filler base. Bottles are positioned under the filler manifold and operator opens fill valve automatically using on/off power switch. Water is dispensed through a pattern of individual nozzles located in the manifold above the bottles, filling all the bottles simultaneously.

4. Construction:

a. Fill head and transport cart shall be fabricated from 304 stainless steel.
b. Splash Hood, Drain Pan, and Legs shall be stainless steel with integral watertight welds. Piping shall be stainless steel. Quick-operating, 1/4-turn Stainless Steel ball valve with Teflon seals and seats. Adjustable feet on filler unit legs.
c. Control panel monitors and controls filing sequence. From control panel, operator can select to fill 8 oz or 16 oz bottles.
d. Quality of water shall be potable, chlorinated TBD by user.
e. Provide additional features:
1). Acid Proportioner
2). pH Monitoring System

5. Provide (4) stainless steel bottle baskets with each unit. Baskets shall be designed to be washed and autoclaved.

6. Utility Requirements:

a.	E	1/60/120V.
b.	CW	1" NPT, 35 PSI +/- 5 PSI.
c.	D	1-1/2" Connection.

B. Equipment item(s) shall be CFCI with MIS.

C. Unit(s) shall be equal to Lynx Product Group Model: 100LX. Unit(s) manufactured by Steris or TBJ shall be considered equal provided that they meet the requirements of this specification.

2.3. CRW: CAGE & RACK WASHER

A. Product Description.

1. Application: The Cage and Rack Washer shall be a heavy duty, large capacity hydro spray washer designed for thorough, efficient cleaning of cages, racks, debris pans and miscellaneous items used in the care of laboratory animals.

2. Size:

a. Minimum Compartment: 46"W x 92"L x 85"H.
b. Maximum External Size: 86"W x 100"L x 104" H.
c. Maximum Pit: 86"W x 101"L x 12" D. Chamber inside bottom shall align with finished floor.
d. Coordinate final pit dimensions, miscellaneous metal requirements related to the equipment and floor drain locations. Steel edging provided along the pit edge shall be furnished and installed by Div. 3.

3. Operation: Operator places items to be cleaned within compartment, closes door and presses automatic cycle push button. Machine proceeds through treatment schedule and automatically shuts off at completion of the cycle. Operator then opens door and removes cleaned items.

4. "Reusable-Throwaway" Alkaline Solution System. Washer shall be provided with the capability to automatically return the alkaline solution to the reservoir or pump to the cool-down/neutralization tank prior to drain.

5. Treatment Schedule: A multiple cycle treatment schedule shall be automatically programmed into the washer as follows (Additional wash, sock and rinse cycles can be added):

a. Pre-Wash: Water remaining in the recirculating sump from final rinse of the previous cycle is recirculated through the jet system under pump pressure and pumped to cool-down/neutralization tank (0-3 minute duration).
b. Alkaline Wash: Hot detergent solution (approximately 115 gallons) from the detergent reservoir fills the sump and is pumped through the jet system. At the end of the treatment, the detergent solution is either

returned to the alkaline detergent reservoir tank or pumped to cool-down/neutralization tank prior to drain discharge at the discretion of the operator. (0-10 minute duration.)

c. Acid Wash: Hot acid solution fills the recirculating sump and is pumped through the jet system. At the end of the treatment, the detergent solution is pumped to cool-down/neutralization tank. (0-10 minute duration.)

d. First rinse: 140°F (60°C) hot water from house supply fills the recirculating sump and is pumped through the jet system. At the end of the treatment, water is pumped to cool-down/neutralization tank. (0-3 minute duration.)

e. Final rinse: Same as the first rinse except at the end of the treatment, the water is retained in the recirculating sump to be used as the pre-wash water for the subsequent load. (0-3 minute duration.)

f. Exhaust: Unit stands idle for a sufficient length of time to remove the residual vapor from the air within the compartment. (0-3 minute duration.)

6. Construction:

a. The base, washing chamber, detergent tank and recirculating sump shall be of welded stainless steel construction. Washing chamber sections shall be flanged and bolted using formed channels across the joints. The base shall contain integral door gutters, recirculating sump and floor grating supports.

b. Each door shall be of double wall construction, insulated with 2" thick rigid fiberglass insulation, and equipped with a double bulb sealing gasket, safety exit hardware, heavy duty hinges, and a minimum 12" x 12" tempered glass observation window.

c. Compartment floor shall consist of heavy-duty stainless steel grating sections covering the entire floor area and pitched 1" at unload end to accommodate poor draining cages, pans and racks. Grating sections shall be easily removable.

d. Recirculating sump shall be equipped with an automatic solution level control, automatic rinse water fill, and stainless steel steam coil heating for the recirculating treatment solutions. An automatic digital temperature controller mounted in the operator's panel shall display and monitor recirculating solution temperature. Recirculating sump shall have no openings beyond the base of the machine to emit vapor from recirculating solutions.

e. Detergent reservoir shall be minimum 250-gallon capacity, heated by stainless steel steam coils. Reservoir shall be equipped with an automatic digital temperature controller, automatic water fill, automatic water level control, automatic drain valve, and overflow piping.

f. All treatments shall be under pressure from two (2) 10 HP full draining type pumps, with no cross-contamination. Pumps are not acceptable if they employ extended shaft motors. The pump system shall be equipped with a direct reading pressure gauge.

g. A stainless steel steam coil heating for the recirculating sump complete with condensate return and steam traps. A by-pass system shall be interpiped into the machine to remove suspended water droplets and

minute particles of debris from the incoming steam line and automatically flush to condensate return. The surface area of steam coils shall be a minimum of 30 square feet for the detergent tank and 60 square feet for the recirculating sump. Steam coils shall be designed to ASME Section VIII, Div 1, Unfired Pressurized Vessel Code and be easily removable for cleaning or maintenance. Coils shall not be welded in place.

h. Each treatment pump shall be equipped with a stainless steel automatic self cleaning screen, minimum 3-1/2" diameter x 18" long manufactured from perforated stainless steel. Screen shall have 1/16" diameter perforations and be interpiped and interwired with motor operated ball valves to collect debris during the treatment portion of each cycle and direct the debris to the sewer when draining any treatment solution. Floor screens that accumulate debris from load to load will not be allowed.

i. Oscillating Jet System shall consist of the following:

1). Eight (8) spray trees suspended from an oscillating carriage. A total of 80 machined jets each capable of 6 GPM @ 40 PSI mounted in the spray trees. Each spray tree shall be equipped with an additional jet spraying outward to rinse the inside cabinet walls.

2). Oscillating system shall be driven by a minimum 1/3 HP motor through a gear reducer. A reversible motor dive system is not acceptable. Driving the oscillating carriage by a rodless air cylinder is acceptable as well.

3). Oil tight micro switches are to be provided to guarantee oscillating reader system covers the entire length of the chamber.

j. Temperature guarantees shall be provided as follows:

1). Final Rinse. Washer shall be provided with a 180°F final rinse temperature guarantee. Final rinse timer will not start timing until recirculating water temperature has reached at least 180°F, thus assuring entire final rinse time at 180°F minimum. Recirculating temperature to reach 180°F within 2-3 minutes after final rinse begins recirculation.

2). Wash Solution. Washer shall be provided with a 180°F (82.2°C) wash solution temperature guarantee. Wash timer will not start timing until recirculating wash solution temperature has reached at least 180°F (82.2°C) , thus assuring entire wash time at 180°F (82.2°C) minimum. Recirculating temperature to reach 180°F (82.2°C) within 2-3 minutes after wash solution begins recirculation.

k. Within the control box shall be transformer for the 1/60/115V control circuit, magnetic starters with overload protection for all motors and all other electrical components required for the machine operation.

l. The following safety features shall be provided:

1). Each door shall be fitted with a magnetic reed switch, which will stop all machine operations if door is opened during the cycle. To resume operation door must be closed and start button must again be pressed.

2). A stainless steel safety cable shall be installed on both sides inside the wash compartment approximately 3'-0" above the floor and runs the entire length. Cable is to be red in color. If the cable is pulled, the machine shall immediately cease all operations. To resume operation, the power must first be turned off, then turned on again and the start button depressed.

3). Each door equipped with spring loaded, explosion relief typed latches that open readily when pushed from inside the cabinet. Latches that lock and/or require additional hardware inside the cabinet to open are not acceptable.

4). Emergency stop buttons provided on load and unload end control panels. Circuitry connected to a normally open relay for added system reliability.

m. Automatically actuated motor ball valves to control output of pump to jet system, drain, or detergent return system.

n. Interpiped and interwired so that only one connection shall be required for each service or utility.

o. Three (3) detergent injection ports and dry electrical contacts for installation of automatic detergent injection. Washer sump shall be equipped with two (2) 1" (25.4 mm) NPT fittings/couplings for connection of external devices.

p. Water line to be protected from hammering by using slow closing valves.

q. Place all serviceable components on either right or left hand side of washer as indicated on the Equipment Drawings.

r. Additional door for pass-through operation complete with safety switch and lights indicating washer is in operation or cycle is complete. Door shall meet all requirements stated above.

s. Chamber shall be insulated on all sides and top with 2" thick fiberglass insulation. A protective stainless steel jacket shall be provided on both sides. The top insulation shall be covered with foil.

t. Solid-state microcomputer control system that monitors and automatically controls all process operations and functions. Provide primary and secondary microprocessor control panels on the load and unload ends of the washer, respectively. Cycle phase times, temperatures and other key process parameters are programmable and may be locked in by supervision. A 12 cycle menu of treatment processes may be programmed and retained to permit operating personnel to accommodate a wide variety of load and processing requirements. Cycle programming shall be controlled by access code to insure process integrity. Each cycle program may be reviewed and printed on demand. The highly visible color touch panel screen shall display cycle program data on demand and real time in process cycle performance. Programming may be in standard AM/PM or military time, temperature in Fahrenheit or Centigrade. Times and temperatures shall be expressed in minutes/seconds and tenths of a degree increments respectively. An internal battery shall back up all cycle memory for up

to one (1) year and permit completion of a cycle upon restoration of power after a power disruption. All cycle deviations are alarmed visually and audibly, recorded and must be acknowledged by the operator. A built-in service diagnostic program, accessible by service access code, shall be provided and displayed to permit system calibration and verification of satisfactory component operation. Provide a strip chart printer with paper take up to record all cycle program and in process performance data. Provide an RS485 port to down load cycle data to a remote computer. All data from control system to communications port shall be in ASCII format compatible with MS Windows support software. Machine to be equipped with 0.1 amp Form C dry contacts to communicate with building DDC system and send a signal when the unit is turned on or off and a door is opened or closed.

u. Ship disassembled into sections that will pass through a 3"-6" x 6'-8" standard doorway.

v. Stainless steel trim flanges to seal opening between the machine and masonry opening.

w. Automatic motorized damper; mounted in the exhaust line and interwired with the automatic cycle. Damper shall be open during exhaust cycle and closed during machine operation.

x. External vapor proof light that shall illuminate the wash compartment.

y. Separate acid detergent treatment after the alkaline wash. Treatment pump and all components and piping that come in contact with acid solutions shall be stainless steel.

z. Cold water injection system to cool effluent from pre-wash cycle. System automatically activated when washer is turned on and controlled and recorded by microprocessor. In addition, a cold water injection system mounted in line to the drain line to cool spent recirculated treatments shall be controlled by an actuated ball valve which automatically opens when sump valves are open. By mixing with cold water, all drain discharges are cooled to a minimum of 140°F, or less, before gravity draining.

aa. Configured to accept future pH neutralization and detergent concentration control system with all necessary couplings, electrical and data connections. Put Rack washer spec.

bb. Instantaneous steam to water heat exchanger to raise hot water supply temperature 60° – 80°F (15.6° – 26.7°C). Heat exchanger is interpiped and interwired for automatic operation.

cc. Stationary spray headers mounted in floor of unit to ensure complete exposure of underside of the load to treatment schedule.

dd. Stainless steel entry/exit pit transition plates to bridge space between unit and pit.

ee. Rack manifold flush system capable of flushing two (2) automatic water racks with house automatic-watering (AW) water during the final rinse cycle. Provide two (2) quick disconnect hoses in wash compartment. System shall be interpiped and interwired for automatic operation.

ff. Provide an integral water heater to service hot water supply lines.

gg. Provide softened hot and cold water service to unit.

hh. Unit shall include a modem and shall allow for online service diagnostics, evaluations and software upgrades by factory service personnel.

ii. The repair technician must be trained and certified by the manufacturer for the equipment being serviced.

jj. Provide integral back-flow preventor as required.

7. Materials (all stainless steel, S.S., type 304):

Item	Material
Base & Recirculating Sump	12 Gauge S.S. #2B Finish.
Door Frames	2" x 2" x 3/16" S.S. Angle.
Door Panels	16 Gauge S.S. #3 finish.
Side and Top Panels	14 Gauge S.S. #3 Finish.
Recirculating Pump Piping	S.S.
Internal Water & Steam Piping	S.S.
External Steam Piping	Schedule 80 Black Iron.
Steam Condensate	Schedule 80 Black Iron
External Water Piping	Brass
Spray Jets	S.S.
Grating	S.S.
Steam Coils	S.S.
Barrier Flange	20 Gauge S.S, #3 Finish.
Insulated Jacket	20 Gauge S.S. #3 Finish

8. Utility Requirements:

a.	E	3/60/208V, 12Hp.
b.	ST	2" NPT, 35-80 PSI, 600#/hour.
c.	HW	1-1/2" NPT, 35 PSI, 50 GPM @ 140F +/-5F.
d.	COND	1" NPT.
e.	D	4" Floor Drain, 120 GPM.
f.	EXH	12" ID, 450 CFM, saturated vapor @ 190F.
g.	A	1/2" NPT, 80-100 PSI, 6 CFM.
h.	CW	1-1/2" NPT, 35 PSI, 60 GPM @ 50F +/-5F.

B. Equipment item(s) shall be CFCI with MIS.

C. Unit(s) shall be equal to Lynx Product Group Model #410LX Cage and Rack Washer. Unit(s) manufactured by Belimed or Steris shall be considered equal provided that they meet the requirements of this specification.

2.4. DW: UNDERCOUNTER DISHWASHER

A. Product Description.

1. The overall dimension of the unit shall not exceed 24"W x 27"Dx 33"H. The minimum chamber size shall be 20"W x 20"H x 20"D.

2. The entire assembly consisting of the body, door, and chamber shall be fabricated of 16 Gauge type 304 stainless steel. Body shall have double-wall construction with closed cell synthetic rubber foam insulation sandwiched between the stainless steel panels.

3. Glassware racks and trays shall be removable and interchangeable among all possible washer levels, with full extension roller slides attached to rack/tray and pinned to prevent accidental roll-out. Rack capacity shall be two, stacked vertically and mounted simultaneously with two potential interchangeable rack locations including bottom rack, and two water header plug-in locations.

4. Injectors shall be mounted in racks with headers inserted into water outlet on back wall of chamber. Injectors shall be threaded for removal, cleanout, and replacement.

5. Spray arms shall be fabricated of type 304 stainless and mounted on floor and top of chamber. Racks and trays with spray arms mounted on bottom, with headers inserted into water outlet on wall of chamber shall be easily disassembled for cleaning and maintenance. There shall be a minimum one at top and one at bottom of wash chamber.

6. Door shall be a drop-down type, spring counterbalanced and capable of supporting a full glassware load when functioning as loading platform. It shall have double-wall construction with insulation to minimize noise and increase in surface temperature. Door shall be provided with a lock to prevent the door from being opened while a wash cycle is in progress. Door shall automatically unlock at the completion of the washing cycle.

7. Unit shall be equipped with a full microprocessor control package that includes sealed program; operation and status membrane touch pads, alpha/numeric display window, cycle end/low detergent audible/visual alarm and printer. Control system shall include at least three pre-programmed cycles (Light, Medium and Heavy) and three custom processing cycles, programmed, retained in memory, and named by the customer. The washing cycle shall consist of programmable pre-wash (selectable cold or hot), detergent wash (selectable hot or very hot), rinse (selectable cold, hot or very hot), thermal rinse (very hot) and pure water rinse (selectable cold or very hot).

8. All control components shall be accessible from a front access panel. Unit shall pull forward to allow for service access to utility components at rear of unit.

9. Supply the following with each unit (one of each unless otherwise noted):

   a. Drain discharge cool-down system to reduce discharges to 140°F or less.
   b. Provide an integral vapor condenser to extract residual moisture from the chamber at the completion of each cycle.
   c. Two (2) General purpose full-width flat rack.

10. Utility Requirements:

a.	E	3/60/208V, 7 kW, 20 Amps/Phase
b.	CW	3/4" NPT, 5.25 GPM, 29-87 psig
c.	HW	3/4" NPT, 5.25 GPM, 29-87 psig
d.	RGW	3/4" NPT, 5.25 GPM, 29-87 psig
e.	D	1-1/2" I.D., 5 GPM, 20-27" AFF
f.	COND	1-1/2" I.D., 5 GPM, 20-27" AFF

B. Equipment item(s) shall be CFCI with MIS.

C. Unit(s) shall be equal to Labconco Laboratory Glassware Washer/Dryer. Unit(s) manufactured by Miele or Steris shall be considered equal provided that they meet the requirements of this specification.

2.5. FUM6: CHEMICAL FUME HOOD

A. Product Description.

1. Fume Hoods shall be variable air volume (VAV) by-pass hoods with a combination (vertical/horizontal) sash, as modified by the below specifications.

2. Each fume hood assembly shall consist of a fume hood superstructure supported by a casework assembly furnished by the laboratory casework contractor. Casework assembly shall include a flammable storage cabinet, corrosive storage cabinet and plumbing cabinet.

   a. Fume hood superstructure and sash enclosure shall be epoxy painted white, or as selected by the architect from the manufacturers full range of colors.
   b. Fume hood superstructure and sash enclosure shall extend 6" above finished ceiling.

3. Fume hood shall be manufactured in accordance with UL standard #1805 and each delivered to the site shall have a UL label affixed. If not available, it will be the responsibility of the hood manufacturer to arrange for a UL "Field evaluated product mark" label, if standard label is not available.

4. It is the intent of this specification to operate all fume hoods at 100 feet per minute (FPM) face velocity (plus or minus 10%) at the 18" vertical sash opening. Manufacturer shall indicate the specific CFM requirements for each fume hood to produce this requirement. Additional opening heights and CFM requirements are listed below.

B. Fume Hood Characteristics.

1. Sash enclosure to assure a leak free chamber.

2. A variable air volume (VAV) restricted by-pass shall be required.

3. Two (2) tube fluorescent light fixtures with electronic ballasts to generate 100 foot-candles of illumination inside hood. Re-lamping done from outside of hood front. Lamps shall be provided under this section. This fixture shall be mounted on 1/4" thick safety glass.

4. The rear and top interior of the hood shall be furnished with baffles to provide three slots that are adjustable in width. The bottom slot shall be covered with a stainless steel screen. Screen to be installed horizontally behind baffle as low as possible and shall have a 1" grid size. Interior clear working height shall not be less than 37" above the work surface. Double wall construction shall enclose structural and mechanical components and service outlets.

5. Hood to be a post-less type unit with counter weights concealed.

6. The sides and top of the face opening shall be designed with aerodynamic considerations such that airflow into the hood is as laminar as possible. Sharp edges and other structures that would disrupt airflow at the face of the hood should be avoided.

7. Side posts of the front face shall be provided with an airfoil. The side posts shall not exceed 4.5" in width.

8. All fume hoods shall be of the airfoil design with an airfoil at the bottom of the face opening. The bottom airfoil shall be raised about one inch from the work surface. The bottom airfoil shall be fabricated from 316 stainless steel.

9. Duct Collar: Stainless steel type 316. Provide stainless steel transition if manufacturer's standard exhaust collar does not meet this requirement. The specific outlet diameter to be determined by Engineer.

10. Access panels on inside of hood chamber shall be gasketed and the outside skin shall be removable to access utilities.

11. A finished rear panel is required if hood is exposed to view. It is to match material and color of the rest of the hood's exterior skin.

12. Vertical sash frame to be of narrow type. Sash frame shall be steel with baked on acid and alkali resistant finish and be welded at intersections, ground smooth and reinforced to support added weight. The sash shall house a 1/4" thick laminated safety glass view screen.

13. The combination (vertical/horizontal) sash shall be movable throughout its travel by application of no more than 5 pounds of force and should remain stationary when force is removed.

14. All fasteners used inside hood chamber shall be protected with plastic "Snap-on" caps.

15. Sash Height Limiting Hardware. Each fume hood to have one set of integral mechanical sash height limiting hardware mounted on the exterior of the hood which prevents raising the vertical sash above certain set points unless manually defeated by operator. Set points to be at approximately 18" above counter top and at the fully closed position. Locks shall employ a swivel lock mechanism that can be disengaged.

16. Cupsinks must be integrally attached and located near the right rear corner. Cupsinks shall also be installed on the countertop and shall not be countersunk in order to avoid inadvertent spills from entering the waste stream.

17. The hood work surface shall be cast epoxy and shall be of the dished type with a 3/8" dish along all four edges. A raised surface shall be provided all around the recessed area of the work surface and it shall be at least 2" wide across the front edge.

18. Sash pocket shall be concealed from view.

19. All fume hoods shall be tested prior to leaving the factory and meet the ASHRAE 110-1995 Tracer gas test protocol with a rating of 4 AM 0.05. Documentation shall be provided.

20. All fume hoods shall be supplied pre-piped and pre-wired for final installation by the relevant trade contractor. All plumbing fixtures shall be installed on the right side post of the fume hood superstructure.

21. Provide integral back-flow prevent or as required.

22. Accessories:

    a. Low Flow Alarm. A Low Flow Alarm shall be accommodated under Division 15 Mechanical. Refer to Specification section 17000.

    b. Fan Operation Control. Provided under Division 15 Mechanical.

    c. Closure Panels: Provide fume hood closure panels from the top of each fume hood to ceiling as required. Manufacturer shall field verify ceiling heights prior to installation. Closure panels to match fume hood superstructure in material and finish.

    d. Base Cabinets: Shall be specified under specification section 12345.

    e. Plumbing Access: Cupsink plumbing shall be accessible through a removable panel located in the rear of the cupsink cabinet.

23. Utility Requirements:

a.	CW	3/8" IPS coupling.
b.	A	3/8" IPS coupling.
c.	G	3/8" IPS coupling.
d.	V	3/8" IPS coupling.
e.	D	Drain required.
f.	EXH	(Refer to Equipment schedule below).

24. The fume hood shall be tested prior to leaving the factory and meet the ASHRAE 110-most current Tracer gas test protocol with a rating of 4 AI 0.1. Documentation shall be provided.

25. Once all hoods are installed and the system is balanced to the satisfaction of the engineer, the fume hood manufacturer will, as part of this specification, test each hood to determine the "as installed" component of the ASHRAE test including the dynamic test component. The most current Tracer gas test protocol with a rating of 4 AI 0.1 and the Flow Visualization and Velocity Procedure tests shall be used. A Professional Engineer shall seal test reports. Reports shall be provided to Owner's Representative. Any hood that fails the face velocity, cross draft or tracer gas component of the test will be re-tested by the Manufacturer once the hood(s) have been rebalanced. The cost of this retest effort shall not be part of this contract. All results will be bound in a report correlating the two test components and will be submitted to the Owner's Representative.

26. It is the fume hood manufacturer's responsibility to construct an operating prototype of the hood they wish to supply for this project and demonstrate its ability to meet this requirement. Such demonstration must be done under controlled conditions in the manufacturer's test facility at their expense, operating the hood at each of the face velocity criteria specified above. Whatever engineering or physical modifications might be necessary to modify the prototype in order to conform to the constant volume requirement will be borne directly by the manufacturer.

27. Once the facility is occupied, the fume hood manufacturer will be responsible, as part of this specification, for conducting an on-site fume hood seminar and supplying the instructional materials noted herein. The location and time seminar will be coordinated with the owner's Chemical Safety Officer and will be made available to all employees. As part of this presentation, the fume hood manufacturer shall provide one (1) copy of the "Prudent Practices for Handling Hazardous Chemicals in Laboratories", published by the National Research Council, (Washington, DC). In addition, they shall provide one (1) copy of the on-site seminar, on CD-ROM, for each fume hood provided affixed to each hood supplied on an unobscured exterior side panel prior to final acceptance by Owner.

C. Equipment item(s) shall be CFCI with MA.

D. Unit(s) shall be equal to Hamilton Laboratory Workstations SafeAire Restricted Bypass Superstructure Unit(s) manufactured by Labconco Corporation, BedcoLab or Kewaunee Scientific Corporation shall be considered equal provided that they meet requirements of this specification.

E. Equipment Schedule:

1. FUM6
   a. Hood Size: 72"W x 54"H x 32"D.
   b. Exhaust Requirement: 670 CFM @ 0.09 w.c. (at 18" sash open.)
   c. Unit shall be pre-piped for cold water, vacuum & natural gas service unless otherwise noted on drawings.
   d. Provide one 120 VAC duplex outlet per side post.
   e. Hamilton Laboratory Workstations Model #: 60L772P.

2.6. ICE: ICE FLAKER

A. Product Description.

1. Unit to be compact, 38"W x 41"H x 28"D, free-standing ice flaker with minimum of 150 pound capacity self-contained insulated storage bin. Unit to produce a minimum of 415 pounds of ice per day (24 hours) at an ambient room air temperature of 70°F and a water inlet temperature of 50°F.

2. The ice making mechanism to have a heavy duty, hermetically sealed compressor; automatic expansion valve refrigerant control: safety control thermostat to turn off ice maker should inlet water pressure become insufficient for ice production or if storage bin reaches maximum capacity. Evaporator to be close tolerance brass cylinder with brass shell, stainless steel auger, completely

insulated with polyurethane foam. Auger to be powered by belt-driven single reduction worm gear. Condensing unit to be air-cooled.

3. Unit shall be provided with a minimum of two (2) year parts and labor warranty and a five (5) year compressor warranty.

4. Utility Requirements:

a.	E	1/60/115V, 3-wire, 14.2 amps
b.	CW	1/4" male flare.
c.	D	5/8" I.D., plastic tubing to drain.

B. Equipment item(s) shall be CFCI.

C. Unit(s) shall be equal to Ice-O-Matic Model #EF450A38S. Unit(s) manufactured by Hoshizaki America or Manitowoc Ice shall be considered equal provided that they meet the requirements of this specification.

2.7. LST: LARGE STEAM STERILIZER – CHAMBER SIZE: 38" X 86" X 86"

A. Product Description:

1. Microcomputer controlled automatic steam sterilizer equipped to employ both high vacuum (accomplished by a high efficient liquid ring vacuum pump to achieve minimum 29" Hg in 5 minutes or less with an empty chamber) and gravity displacement method of air removal. Microprocessor with tactile touchpad interface will control all system functions, monitor system operations, visually and audibly alert operator of cycle malfunctions, and, on command, visually indicate chamber temperature and pressure. Integrity of piping and door seals monitored with preprogrammed leak test. Solid state printer with clear waterproof cover shall document and record each cycle's performance with such data as time and date that unit is opened, cycle number, set points and cycle selected. Full controls, as described above, on load side. Where noted on Equipment Schedule, provide partial controls, cycle selection only, on unload side. RS232 port to down load cycle data to a remote computer. All data from control system to communications port in ASCII format compatible with building support software. Provide 0.1 Amp Form C dry contacts to communicate with building DDC system and send a signal when unit is turned on or off and a door is opened or closed.

2. Unit design shall allow for "general purpose" steam sterilization of unwrapped equipment, wrapped instruments and utensils, cages, racks, water bottles, wire bar lids and liquids in vented or unsealed containers at temperatures ranging from 100 - 138°C (212 - 280°F). Cycle times for dry, wrapped goods shall not exceed a guaranteed 60 minutes from door closed to door open. Temperature uniformity within chamber +/-1.8°C (+/-2°F) during cycles. Unit designed to meet or exceed ASME Code for Unfired Pressure Vessels, Section VIII (U-1 stamp of compliance); ASME Boiler and Pressure Vessel Code, Section IX; American Welding Society (AWS); ASTM; ANSI; NEMA; NEC; OSHA.

3. Sterilizer chamber interior dimensions per Equipment Schedule and constructed of solid type 316L stainless steel with an internal finish of 10 RA or better and jacketing constructed of type 304 or 316L stainless steel. Chamber completely

insulated with minimum 2" mineral wool encased in a rigid removable sheet aluminum housing. Unit configured per Equipment Schedule with all exposed surfaces stainless steel. Pit dimensions, miscellaneous metal requirements and floor drain location per Drawings with no deviation permitted. Provide adjustable legs and an integral threshold plate to facilitate rack loading (gap between pit edge and chamber shall not exceed 3/4"). Chamber bottom shall align with finished floor +/-1/32". Provide access panel on load side fascia. All serviceable components to be skid mounted on one side of chamber accessible from access panel in fascia or access door. Piping to chamber shall be stainless steel. All installations continuously silicone caulked around perimeter of fascia. Provide stainless steel closure panel between top of unit and ceiling and all necessary ceiling and wall trim angles. Provide power operated horizontal sliding doors with automatic sealing, safety interlocks, and cross-contamination interlocks.

4. Provide unit with, unless otherwise noted:

   a. Chamber rub rails.
   b. Self-Cleaning drain line strainer consisting of appropriate piping to automatically flush the drain line strainer prior to completion of a sterilize cycle. Back-flushed debris should not reenter the chamber. A rough strainer can be provided within the chamber to prevent large objects from clogging the drain pipe prior to the fine strainer and/or allow casters to pass over drain.
   c. Drain discharge cool-down system to reduce all discharges to 140°F, or less.
   d. Provide integral back-flow preventor as required.

5. Unit shall carry a two (2) year warranty. Vessel and door will carry a fifteen (15) year warranty.

6. Unit shall be a pit mounted, double door unit, recessed through two walls. Provide full controls on load and unload sides of unit and a 2" high guide rail mounted at bottom center of chamber.

7. Utility Requirements:

   a. E1 3/60/208V, 150 Fused Amps.
   b. D 2" ID.
   c. CA 7 CFM.
   d. CW 55 GPM.
   e. ST 1,600 lbs/hour.

B. Equipment item(s) CFCI with MA.

C. Unit(s) shall be equal to a Belimed Model #21-921HS2 49"W x 86"H x 86"D. Units manufactured by, Steris or Primus shall be considered equal, provided that they meet the requirements of this specification

2.8. ST1: STEAM STERILIZER – CHAMBER SIZE: 26" X 26" X 38"

A. Product Description.

1. Microcomputer controlled automatic steam sterilizer equipped to employ both high vacuum (accomplished with a mechanical vacuum pump to achieve minimum 27" Hg in 5 minutes or less) and gravity displacement method of air removal. Microprocessor shall control all system functions, monitor system operations, visually and audibly alert operator of cycle malfunctions, and, on command, visually indicate chamber temperature and pressure. Integrity of piping and door seals monitored with preprogrammed leak test. Solid-state printer shall document and record each cycle's performance with such data as time and date that unit is opened, cycle number, set points and cycle selected. RS485 port to down load cycle data to a remote computer. All data from control system to communications port in ASCII format compatible with building support software. Provide 0.1 amp Form C dry contacts to communicate with building DDC system and send a signal when unit is turned on or off and a door is opened or closed.

2. Unit design shall allow for general purpose steam sterilization of unwrapped equipment, wrapped instruments and utensils, and liquids in vented or unsealed containers at temperatures ranging from 100° - 138°C (212° - 280°F). Temperature uniformity within chamber +/-1.8°C during cycles. Unit designed to meet or exceed Federal Specification GG-SS-1340A; Underwriter's Laboratory (UL) as certified by ETL Testing Laboratories; ASME Code, Section VIII, Division 1 (U-1 stamp of compliance); ASME Code, Section 1, Part PMB (with generator).

3. Sterilizer chamber interior dimensions per Equipment Schedule and constructed of solid type 316L stainless steel with an internal glass bead finish (35 RA or better) and jacketing constructed of type 304 stainless steel. Chamber completely insulated with minimum 2" mineral wool encased in a rigid removable sheet aluminum or stainless steel housing. Unit configured per Equipment Schedule with all exposed surfaces stainless steel. All installations continuously silicone caulked around perimeter of fascia. All serviceable components accessible from front and one side of unit and if multiple units are installed, locate components so they will be accessible from common access isles. Provide hinged doors with automatic sealing, safety interlocks.

4. Internal piping and valves components to be 316 stainless steel. Valves to be ball type.

5. Provide local steam to steam generator.

6. Provide integral back-flow preventor as required.

7. Provide with each unit:

   a. One (1) loading cart and carriage.
   b. Drain discharge cool-down system to reduce discharges to 140°F or less.

8. Unit shall carry a two (2) year warranty (including door seal gaskets) and vessel to carry a fifteen (15) year warranty.

9. Utility Requirements:

   a. E 3/60/208V, fused at 6 Amps/Phase.

b. ST 1" NPT, 50-80 psig dynamic, 255 lbs/hr. peak, condensate free, 97% to 100% vapor quality.
c. CW 1" NPT, 20-50 psig, 15 gpm peak.
d. D 2" ODT drain terminal, 15 gpm peak.
e. HEAT 6.4kBtu/hr heat rejection to equipment service area; 1.3kBtu/hr heat rejection to loading area; 1.3kBtu/hr heat rejection to unloading area.
f. SPCL Dry contacts for DDC.

B. Equipment item(s) shall be CFCI with MIS.

C. Unit(s) shall be equal to a Belimed Medium Steam Sterilizer 26" x 26"x 38". Unit(s) manufactured by Steris or Primus shall be considered equal provided that they meet requirements of this specification.

D. Equipment Schedule:

1. ST1
   a. Chamber Size: 26"W x 26"H x 38"D.
   b. Configuration: Single door, recessed through one wall.

2.9. BSC6PT: Biological Safety Cabinet Pass-Through Class 11/B3

A. Product Description:

1. Unit utilized as a pass-through class II, type B3 biological safety cabinet with views screens on load (non-barrier) and unload (barrier) side. Provide a certified copy of Personnel, Product and Cross-contamination (Biological) Tests, equivalent to or more severe than as specified in NSF Standard #49, performed on one unit from each production run from which cabinets have been manufactured. All units must meet NSF #49 performance requirements.

2. Cabinet will have zoned or uniform down flow velocity profile relative to down flow velocity over work surface. All biologically contaminated ducts and plenums shall be maintained under negative pressure or enclosed within a negative pressure zone.

3. Dual sliding or hinged view screens of 1/4" tempered glass. Calculated intake velocity through front 12" access opening maintained between 100-110 fpm.

4. Both exhaust and supply filters to be front loading and meet zero-probed HEPA 99.99% efficient on all particles 0.3 micron by DOP test. Magnehelic pressure gauge(s), up to 2" W.G., to monitor filter loading.

5. Cabinet constructed of #18 gauge cold-rolled steel, with #16 gauge stainless steel work surface and radius (rounded) corners on work surface. Side walls one-piece or welded construction. Stainless steel air diffuser and filter protector provided in work area. Unit supported on four NSF adjustable legs and installed with work surface height at 36" AFF. Provide stainless steel closure panels and barrier wall flanges with mitered corners to completely close off wall and sealed opening between load and unload sides.

6. Work area provided with 2 internally mounted GFI duplex 120V outlets with drip-proof covers and circuit breakers. Provide a fluorescent light (100 foot-candles of illumination at work surface).

7. Unit capable of automatically handling a 60% minimum increase in filter loading without a decrease in total air delivery of more than 10%. Provide voltage compensating motor speed controller(s) that automatically compensates for voltage changes to maintain constant voltage to motor(s). Speed controller(s) will permit manual adjustment to handle a 150% increase in filter loading and maintain total air delivery at or above 90%.

8. Provide one (1) thimble per exhaust connection to building exhaust system. Thimble(s) shall be 16 gauge cold rolled steel construction. Provide decontamination plates.

9. Unit shall be completely factory pre-wired and have a 30 amp 6' power cord. Supply a 0.1 Amp form "C" contact on blower switch to interact with a potential room control package. Complete units shall be listed as certified by UL (UL 3101-1) or ETL for electrical safety and integrity.

10. Unit to carry a three (3) year warranty.
11. Utility Requirements:

    a. Elec 1/60/115V 21 amps.
    b. Exh 2@8" dia., 410 cfm each.

B. Equipment item(s) shall be MIS.

C. Unit(s) shall be equal to NuAire NU-610-600 6' nominal length Double Access Class II, Type B3 Biological Safety Cabinet. Unit(s) manufactured by Baker shall be considered equal provided that they meet requirements of this specification.

2.10. BDS: Bedding Disposal System

A. Product Description.

1. Bedding Disposal System is designed to support the function of dumping and containing animal bedding waste that minimizes allergen and contaminant exposure.

2. Size:

    a. Overall Dimensions: 50" W x 29" D x 79" H

    b. Work Area: 44" W x 28" D x 24" H

B. Construction:

1. Bedding Disposal System provides a 16-inch work access opening providing personnel protection for handling low to moderate risk material. The Class I cabinet allows room air to flow over work surface.

2. Controlled air inflow establishes a uniform air barrier as air enters cabinet, flowing past operator through a 16-inch work access opening at a recommended minimum of not less than 75 FPM or 105 FPM nominal providing an air barrier which minimizes contaminants generated within work zone from migrating into room. Work zone air is drawn up under negative pressure through 3 filters in series:

   a. Prefilter; preserving life of HEPA filter.

   b. HEPA filter; removing 99.99% of all particulate 0.3 microns in size.

   c. Sorbent filter; removing odors such as ammonia.

3. Air enters the blower compartment where it exits from top rear of the cabinet through a grill. Entire airflow path from work access opening and cabinet's interior to the blower compartment is under a vacuum relative to the room precluding any unfiltered leakage to room. Hinged front doors provide access to waste receptacle. Slanted viewing window is hinged and locks into the full open position to facilitate interior cleaning.

4. Provide worksurface disposal funnel for dumping small to medium sized cages. All stainless steel single piece construction with the funnel being spun. Provide bang bar welded over funnel to knock out bedding material loose from cages.

5. Electronic Airflow Monitor. To insure an adequate mass flow through the work access opening at all times, an airflow monitor constantly monitors the exhaust efflux using two self-heated thermisters to detect airflow velocity. Audible and visual alarms are provided should airflow fall below the desired minimum set point for containment. Low flow display could occur as a result of (1) motor failure, (2) dirty prefilter, (3) loaded HEPA filter, (4) power "brown-out", or (5) failure of the Airflow Monitor itself.

6. Provide cabinet castored with locking brakes and push/pull bars on each side with waste receptacle on its own castored platform within the cabinet base.

7. Unit contains clear acrylic side panels, a full width by 16-inch high work access opening with a clear acrylic slanted hinged window and an externally located fluorescent light all combine to provide the maximum level of visibility and accessibility for the work in process.

8. Controls and indicators shall be contained within a removable control module constructed of 16 gauge cold-rolled steel placed at eye. All connections from control module to the cabinet are quick-disconnect plugs and receptacles.

9. System shall contain three modular sections:

   a. Base cabinet that contains the disposal delivery system

   b. Work space consisting of acrylic panels and work surface

   c. HEPA/Sorbent blower module.

10. Base cabinet shall be constructed of Type 304 stainless steel including the metal parts of the castors. Side panels and back panels are fabricated from a single

piece of metal. Double access reinforced doors hinged with full-length stainless steel piano hinge.

11. The work space consists of:

    a. White acrylic rear panel

    b. Clear acrylic side panels

    c. Clear, hinged polycarbonate front panel,

    d. 16 gauge, type 304 stainless steel work surface. Work surface is hinged to back panel and is raised to perform bag installation and removal.

12. HEPA/sorbent/blower module shall be constructed in two pieces from 16 gauge cold-rolled steel. The lower stationary half houses HEPA filter. The upper half is hinged and contains blower, rear outlet grill containing the sorbent filter. Two gas springs are provided to hold the upper half open. The module is finished in textured baked urethane.

13. All other cabinet surfaces, interior and exterior, are constructed of, or finished with, materials which are corrosion, flame and moisture resistant and shall not deteriorate under exposure to liquid or vapor phase decontaminates such as formaldehyde, alcohol, iodophors, peracetic acid, and halogenated phenols. Hypochlorite solutions may damage stainless steel if not immediately removed with clean water. Do not use any chlorinated or halogen materials.

14. Textured baked urethane finish shall be a high-solids chemical agent resistant coating (CARC), and meet new EPA solvent emission regulations with less than 3.5 lb/gal volatile organic content. CARC coating contains no chlorinated hydrocarbons and withstands chemical and biological reagents absorption into paint.

15. Unit contains motorized impeller to exhaust air. Motor is mounted inside impeller such that it is the stator that rotates with the impeller. Both are balanced as an integral unit, leading to vibration-free performance.

16. Impeller and motor combination are fabricated of or protected with corrosion resistant materials to withstand normal laboratory or chemical fumes. Blower/motor shall automatically compensate for airflow as the filters load with particulate to achieve a fan delivery fall off of no more than 10% as a result of a 50% increase in pressure drop across the filters. With the use of the speed control a greater than 150% increase in pressure drop across the filters is achievable.

17. Motor shall be a 4-pole permanent split capacitor (PSC) type, permitting full range of voltage reduced operation via a solid-state speed control. The motor requires single phase, 50/60Hz power and will not exceed a temperature of 105°C in a minimum ambient temperature of 48°C (120°F) under any maximum load condition. Thermal protector will not trip at 115% of the rated voltage under maximum load and ambient temperature conditions. Motor is rated for 24-hour continuous operation and is lubricated for life.

18. Provide HEPA filter of standard construction consisting of non-woven fiberglass media, pleated between aluminum separators and sealed in a Chipboard frame. Media shall be rated hi-capacity (i.e. super flow) and be 99.99% efficient on particulate 0.3 micron in size with greater efficiency on larger and/or smaller particles. HEPA filters shall conform to Institute of Environmental Sciences Specifications Number IES-RP-CC-001-83-T, Grade 2, Type C.

19. Sorbent filter consists of an adsorbent material that is activated charcoal made from virgin coconut shells with a well developed pore structure (approximately 1100-1200 m^2/gm) allowing for a wide range of adsorbate retention and is particularly well-suited for removal of organic contaminants.

20. Prefilter is 1 inch thick disposable, non-woven framed fiberglass media with a nominal efficiency of 40% by NBS Test Method using atmospheric dust. Prefilter shall be held in place on a hinged frame that swings down into work surface.

21. Fluorescent lamp is cool white, rapid start type, located outside of the work space, shielded from direct view.

22. Provide complete electrical protection for both operator and equipment. All electrical components shall be U.L., CSA or V.D.E. recognized and the cabinet shell and all components are grounded back to electrical source. A 12-foot power cord is provided. All electrical construction features have been designed to the requirements of U.L., CSA and V.D.E. for laboratory equipment.

23. Utility Requirements:

    a. E1 1/60/120V, 30 Amp.

C. Equipment item(s) shall be CFCI.

D. Unit shall be equal to NuAire Model: NU-607 Bedding Disposal System. Unit(s) manufactured by TBJ shall be considered equal, provided they meet the requirements of this specification.

2.11. BSC/B1: Biological Safety Cabinet Class II/Type B1, 70% exhausted bio-safety cabinet

A. Manufacturer shall provide a certified copy of the Personnel, Product and Cross-contamination (Biological) Tests, equivalent to or more severe than as specified in NSF Standard #49, performed on one unit from each production run from which cabinets have been manufactured. All units must meet NSF #49 performance requirements and, if sash opening is 8", appropriate NSF label affixed.

B. Cabinet shall have zoned or uniform down flow velocity profile relative to down flow velocity over the work surface. All biologically contaminated ducts and plenums shall be maintained under negative pressure or enclosed within a negative pressure zone.

C. Sliding view screen of 1/4" tempered glass shall be capable of moving to a fully closed position during shut down periods. Unit shall have audible alarm to indicate when view screen is in unsafe position.

D. Both exhaust and supply filters to be front loading and meet the zero-probed HEPA 99.99% efficient on all particles 0.3 micron by DOP test. Equip unit with minihelic pressure gage (up to 2" W.G.) to monitor filter loading. The cabinet shall be provided with a flow control station to alarm with the airflow is 30 percent below velocity range for certification.

E. Cabinet to be constructed of cold-rolled steel, with stainless steel work surface. Provide radius (rounded) corners on the work surface. Side walls and rear wall to be one-piece or welded construction. Stainless steel air diffuser and filter protector to be provided in work area. Stainless steel adjustable leg assembly shall be provided, enabling unit to be shipped at a maximum 84" height overall. Legs to be removable and adjustable on 1" increments, to vary the work surface height between 30" and 36" AFF. All units shall be installed with the work surface height at 30" AFF unless otherwise indicated on the Drawings or instructed by Owner's Representative prior to installation.

F. Equip each unit with a voltage compensating motor speed controller that automatically compensates for voltage changes to maintain constant voltage to motor. Speed controller shall permit manual adjustment to handle a 180% (6' units) increase in filter loading and maintain total air delivery at or above 90%.

G. Equip unit with a 24" high, 12" diameter stainless steel duct section for connection to building exhaust system. Duct section to be furnished with integral air-tight/gas-tight damper, damper control and housing for air flow monitor, all located below hung ceiling. Monitor probe to be factory installed.

H. Provide low flow sensing device whose probe will be mounted in 12" high duct section to monitor total exhaust capacity. This device shall include the following factory wired and assembled components:

1. One monitor which includes tricolor jumbo LED indicator lights, (green: normal airflow; yellow caution; red; low flow), electronic analog meter (with green, yellow and red zones) and audible alarm. In addition there shall be a switch to silence the audible alarm and a separate indication that the audible alarm has been silenced.
2. One (1) airflow sensor probe.
3. One (1) Transformer: 120VAC input.
4. Appropriate mounting brackets and hardware to install the monitor and probe to the bio safety cabinet.
5. The probe shall be factory calibrated to the monitor thereby eliminating field calibration.
6. The monitor shall have a factory reset operating range of 500-2000 feet per minute (FPM).
7. There shall be an LCD that displays status indicators and icons indicating operating mode and conditions and, in the user's option, the measured airflow velocity in feet per minute (fpm) or meters per second (m/s).
8. The monitor shall have a night setback capability.
9. Unit shall be capable of operating at 10°-30°C.
10. The monitor shall have a relay output.
11. Alarm manufacturers: Alnor Corporation #Airgard-335BSC, Air Monitor Corporation or Flow Safe Corporation.

I. Unit shall be supplied with a pressure differential switch to automatically shut off supply blower in event of exhaust failure and a self-contained filter changing isolation system, including a disposable bag.

J. Unit shall be completely factory pre-wired and have a 10' (3048 mm) power cord. In addition, supply a 0.1 Amp form "C" contact on the blower switch to interact with a potential room control package. Complete units, including flow alarm, shall be listed as certified by UL or ETL, for electrical safety and integrity.

K. Utility Requirements:

1. E 1/60/115V 20 ampere dedicated.
2. EXH 256 CFM (435.00 CMH) at 0.4" w.g. (.10 kPa), "hard" connect. 281 CFM at 0.70" w.g.

L. Equipment item(s) shall be CFCI.

M. Unit to carry a three (3) year warranty.

N. Unit(s) shall be equal to Baker NCB-D6 (6ft nominal length) Class II, Type B1 Biological Safety Cabinet. Unit(s) manufactured by Nuaire shall be considered equal provided that they meet the requirements of this specification.

2.12. D: DRYER

A. Product Description

1. Unit shall be a front loading tumble dryer with adjustable temperature controls, electronic moisture measuring and time controls (0-60 minutes). Safety thermostats shall monitor drying progress and control maximum temperatures. A clear indicator shall show when the lint filter requires cleaning. The drum shall turn clockwise and counter-clockwise alternately, to ensure even drying. Cool air shall be circulated through the laundry at the end of the program. Provide integral vapor condenser to eliminate need to vent unit.

2. Unit shall be provided with a minimum of three (3) temperature settings and be capable of storing in memory up to 18 programmable drying cycles.

3. Performance shall be as follows:

a. Load (cu. ft.): 6
b. Fan capacity (cu. ft./min.): 220
c. Running time for "dry to put away" (approx. min.): 45.

4. Unit shall be electric-heated, free-standing, approximately 27"W x 43"H x 30"D with stainless steel cabinet and drum.

5. Utility Requirements:

a. E 60/3/240V 30A mp fuse.

B. Equipment item(s) shall be CFCI with MED.

C. Unit(s) shall be equal to Maytag Unimac Model # UDE007. Unit(s) manufactured by Huebsch or Speed Queen shall be considered equal provided that they meet the requirements of this specification

2.13. W: Washer

A. Product Description.

1. Unit shall be a front loading washer with programmable, adjustable controls via a membrane touchpad and LCD screen. Programmable controls shall include seven automatic washing programs (white/colors with/without pre-wash, non-iron with/without pre-wash, delicates/synthetics with/without pre-wash, wool), one-to-two detergent dispensers, seven controls (start, stop, 1/2 load starch without spin open door, off), five cycle programs (start, pre-wash, wash, rinse, spin) and ten temperatures (0°C, 20°C, 30°C,40°C, 50°C, 60°C, 70°C, 80°C, 85°C, 95°C).

2. Unit shall be electric-heated, free-standing, approximately 27"W x 42"H x 28"D with stainless steel cabinet and drum. Provide integral hot and cold water valves and large drain valve. Provide three-compartment detergent dispenser.

3. Performance shall be as follows:

a. Load (cu. ft.): 3.5
b. Motor (hp): 7/8
c. Running time for "Cottons" at 95°C (approx. min): 63.
   1) Safety features shall include a water level-dependent door lock to guarantee that the drum door cannot open during washing process and an electric out of balance monitor that will interrupt process if imbalance is too great.
d. Utility Requirements:
   1) E 1/60/120V 15A fuse.
   2) HW 1/2" pressure hose, 20-120 psi, 120°-140°F
   3) CW 1/2" pressure hose, 20-120 psi
   4) D 1-1/2" O.D. standpipe, 36" AFF

4. Equipment item(s) shall be CFCI with MED.

5. Unit(s) shall be equal to Maytag Model # FAV7500AWW Neptune clothes washer. Unit(s) manufactured by Miele, Inc. or Unimac, Inc. shall be considered equal provided that they meet the requirements of this specification.

2.14. MW: Modular Wall

A. Modular wall panel box sections shall be finished on exposed side with type 302/304 stainless steel, #3 finish, and in-filled with a moisture-resistant, sound-deadening insulation. A finished stainless steel panel shall not be provided on the mechanical, service side, of the modular wall. Insulation shall be exposed to view in these areas.

B. Sectional modular wall shall be as indicated on the Drawings (length and height shall be field verified) and nominally 2" thick. Modular wall shall completely seal openings between equipment, walls, floors and ceiling.

C. Provide 36" x 84" stainless steel doors where noted with a 24" x 24" tempered glass vision window and 24" x 24" grille (50% free area) in the door. Door hardware to be selected by Owner and furnished and installed by manufacturer.

D. Equipment item(s) shall be CFCI with MIS.

E. Unit(s) shall be equal to Steris. Unit(s) manufactured by MATRIX Scientific shall be considered equal provided that they meet the requirements of this specification.

2.15. LAM6: Laminar Flow Workstation-Vertical

A. Product Description.

1. Workstation shall provide a smooth, uniform airflow, free from turbulence. Minimum air turbulence shall be is provided with workzone enclosure and be an extension of flow area of HEPA filter. Workstation will include transparent side panels to encompass a clean work zone.

B. Construction:

1. Vertical laminar flow workstation shall utilize a high efficient motorized impeller to distribute air evenly over HEPA filter providing 90 fpm of laminar airflow to workzone and shall contain a replaceable prefilter to remove large particulate.

2. HEPA Filter System shall be 99.99% efficient on removal of all aerosol particulate contaminants 0.3 microns and larger and shall meet or exceed requirements of ISO 14644 Class 5 Air Quality.

3. Workstation will contain fluorescent lamps and provide 100 foot-candles on the work surface.

4. Workstation shall contain an Instrument Panel providing:

a. On/Off Switch for Motorized Impeller
b. On/Off Switch for Fluorescent Lights and optional UV Lights
c. Minihelic gauge to monitor filter loading.

5. Workstation airflow shall be controlled by solid state motor voltage regulator with adjustment available on control center.

6. Workstation shall be listed by Underwriters Laboratories and meet requirements of both U.S. and Canada for Electrical/Mechanical integrity.

7. Workstation shall be transportable through a 34-inch wide standard door and shall be completely serviceable from front of unit.

8. Workstation finish shall be textured, baked white enamel for easy cleaning; work surface shall be stainless steel. Unit will include a quick-disconnects module.

9. Workzone shall be enclosed with clear polycarbonate side panels with gasketed service ports; clear polycarbonate hinged viewing window and white polycarbonate back wall.

10. Provide the following features

    a. IV Bar w/six stainless steel hooks,
    b. Base Support Stands
    c. Duplex Outlets.

C. Utility Requirements:

    a. E1 1/60/120V, 20 Amps.

D. Equipment item(s) shall be CFCI with MED.

E. Unit(s) (s) shall be equal to NuAire Model NU-126-600 Vertical Flow Clean Workstation. Unit(s) manufactured by Baker shall be considered equal provided that they meet the requirements of this specification.

2.16. LAM6: Laminar Flow Workstation-Horizontal

A. Product Description.

1. Provide HEPEX disposable inner pressure plenum to prevent leakage through the HEPA Filter Seal and maintain Federal Standard 209b Class 100 on unit.

2. Workstation shall provide smooth, uniform airflow, free from turbulence. Minimum air turbulence shall be provided with work zone enclosure be an extension of actual flow area of the HEPA filter. Clean Benches shall contain transparent side panels.

B. Construction:

1. HEPEX pressure plenum shall be disposable and fabricated of flameproof, antibacterial materials accepted by recognized authoritative agencies, New York City Board of Standards and Appeals (Calendar No. 207-64-SM), California State Fire Marshall (FI-222), U.S. Coast Guard, U.S. Dept. of Commerce, and other regulatory authorities.

2. HEPEX System shall be 99.99% efficient on removal of all aerosol particulate contaminants 0.3 microns and larger and shall meet or exceed requirements of Federal Standard 209b for Class 100 air quality.

3. Horizontal Flow Clean Bench shall contain fluorescent lamps and provide a lighting intensity of 200 foot candles on the work surface.

4. Horizontal Flow Clean Bench shall contain an Instrument Panel providing:

    a. On/Off Switch for Motor/Blower
    b. On/Off Switch for Fluorescent Lights
    c. Speed Control for Blower (recessed).

5. Cabinet finish shall be textured, baked white enamel for easy cleaning; work surface shall be stainless steel. Unit will include a quick-disconnects module.

6. Bench shall be transportable through a 34-inch wide standard door and shall be completely serviceable from front of unit.

7. Cabinet workzone shall be enclosed with Plexiglas hood.

C. Utility Requirements:

a. E1 1/60/120V, 20 Amps.

D. Equipment item(s) shall be CFCI with MED.

E. Unit(s) (s) shall be equal to NuAire Model NU-201 6' Horizontal Flow Clean Bench Unit(s) manufactured by Baker shall be considered equal provided that they meet the requirements of this specification.

PART 3 EXECUTION

3.1. INSPECTION

A. Check for shipping damage. Reject units with scratches, dents or other defects that cannot be readily corrected.

B. Check job site to insure that rough-ins and substrates are correct and that equipment will fit as indicated on Equipment Drawings.

C. Do not proceed with installation until defects or oversights are corrected.

3.2. INSTALLATION

A. Deliver equipment to the job site freight paid.

B. Uncrate all equipment and place in locations shown on Equipment Drawings. Remove all crating materials and packing debris.

C. Install all items in accordance with Manufacturer's standards. Provide all accessories necessary for a complete installation.

D. Verify plumbing, ventilation and electrical connection requirements for all equipment and coordinate connections with work of Divisions 15 and 16.

3.3. ADJUST AND CLEAN

A. Check operation and installation of equipment. Make adjustments as necessary to meet Manufacturer's or these specifications (whichever is more stringent).

B. Replace items which do not operate properly, have defacing marks or damage which cannot be satisfactorily repaired as determined by the Owner's Representative.

C. Clean and polish equipment in accordance with Manufacturer's recommendations before and after demonstration for Owner. Leave ready for use with copy of Operation and

Maintenance Manual attached to equipment in a manner to be specified by Owner's Representative.

D. Each manufacturer shall submit with his Contract Price proposal an itemized list of available accessories for Owner's selection as part of this work. Provide unit prices for these accessory items; unit price cost shall be valid through entire construction period of project and for an additional 90 days after substantial completion.

3.4. SERVICE CONTRACT

A. Each manufacturer shall submit a service contract for his piece of equipment and cost of same. Owner shall determine if contracts are to be accepted.

END OF SECTION 11710

SECTION 12345 - LABORATORY CASEWORK

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of contract including General and Supplementary Conditions and Division Specification sections apply to work of this section.

1.2. SCOPE

A. Furnishing of materials, products, accessories, tools, equipment, services, scaffolding, ladders, transportation, supervision, labor, product protection, and other items that may not be specifically mentioned, but are necessary for the fabrication and installation of laboratory casework.

B. Furnish and install cabinets and furniture including, but not limited to, counter tops, standards, slotted studs, filler panels, scribes, knee space panels, casework in environmental rooms and miscellaneous items of equipment as listed in these specifications and as shown on drawings, including delivery to the building, unpacking, setting in place, leveling and scribing to walls and floors as required.

C. Furnish and deliver packed in boxes for receipt, handling and set in place for installation by others; laboratory sinks, cup sinks, cup drains, overflows and sink outlets with integral or separate pieces, service fittings where part of the laboratory furniture, listed in the specifications or shown on drawings. Tailpieces shall be furnished less couplings required to connect to the trap or drain piping system.

D. Remove debris, dirt and rubbish accumulated as a result of installation of this equipment and leave premises clean and orderly.

E. A factory trained representative of the manufacturer shall provide three (3) on-site demonstrations to Owner.

1.3. RELATED WORK

A. Furnishing, installation and connection of "Service Lines" within and/or attached to equipment, utility drop, slotted studs, partitions, service tunnels or service turrets, through, under or along backs of working surfaces as required for "Service Fixtures."

B. Receiving, installing and connecting "Service Fixtures" furnished by laboratory furniture manufacturer including the pulling of wire and connecting of electrical fixtures in service lines.

C. Furnishing, installing and connecting vents and drain lines.

D. Furnishing, installing, setting and connecting special electrical and plumbing fixtures and piping to meet local codes, even though not specifically called for in specifications and shown on drawings.

E. Furnishing, handling and installing fans with motors (blowers).

F. Furnishing and installing of framing or reinforcements for wall, floors and ceilings to adequately support laboratory equipment and brick, plaster, metal or wood grounds required for proper anchoring of the equipment.

G. Furnishing fluorescent tubes (not in task lights), light bulbs, and/or any miscellaneous materials generally classified as maintenance or supply items.

H. Furnish and install pipe hangers.

I. Furnish and install rubber base molding after laboratory casework is installed.

J. Furnishing and installing hoist or elevator with operator to enable laboratory furniture manufacturer to locate the casework in the proper areas.

1.4. CASEWORK SYSTEM

A. Fifty percent (50%) of the cabinets with non-marring glides or otherwise noted must incorporate "Add-A-Drawer" furniture design to allow casework to be used in both standing and sitting height configuration and shall be constructed as follows:
   1. Top of the base cabinet shall be plastic laminate (color selected by Architect) with 3/4" wide x 1/8" thick edge banding on four sides.
   2. A fully enclosed drawer box made same width as cabinet below, shall sit on top of each base cabinet to create a standing height cabinet. Top of the apron shall be plastic laminate (color selected by Architect) with 3/4" wide x 1/8" thick edge banding on four sides.
   3. Apron shall be aligned with two (2) stainless steel pins that engage cabinet's top rail through pre-drilled holes with full diameter metal inserts. In addition (1) camlock mechanism equal to Hafele # 261059902/993/984 shall be located at the rear of the base cabinet to lock the add-a-drawer apron to the cabinet.
   4. Table height, to top of counter top, shall be set at 36" unless otherwise noted on drawings to allow a refrigerator to be installed below. The table shall have a 2" high apron at front and 6" at sides and back.
   5. Drawer units must be equipped with an anti-tipping mechanism that shall include an interlock so that only one drawer in a vertical stack can be opened at one time.

B. Drawer units that will not incorporate "Add-A-Drawer" furniture design will be standing height.

1.5. DEFINITIONS

A. "Add-A-Drawer" refers to a generic system of flexible laboratory furniture; it does not refer to a particular brand or manufacturer.

B. "Laboratory Furniture Contractor" is defined as the manufacturer and/or manufacturer's representative furnishing the laboratory equipment listed under these specifications, laboratory equipment schedule and/or shown on drawings.

C. "Service Fixtures" are defined as gas, air, and vacuum cocks, hot, cold, reagent grade water faucets, remote control valves, electrical receptacles with necessary flush mounting

boxes, conduits or pedestals and plates, fluorescent and/or incandescent light fixtures, light switches and/or motor switches for hoods and other items which serve as a functional part of the equipment.

D. "Service Lines" are defined as gas, air, vacuum, hot, cold, reagent grade and reference grade water piping, drain lines, fittings and shut off valves necessary to carry respective services from building roughing-in floors or walls through equipment to "service fixture".

E. "Service Lines" also include conduit, junction boxes, conduit fitting, wire disconnect switches and fuse or circuit breakers necessary to carry electrical services from building roughing-in outlets in floors or walls through equipment to "service fixtures".

F. "Standards" are wall mounted, twin-tracked standards.

G. "Slotted Studs" are double-faced, twin-tracked studs comprising the frame spanning between the utility chase and the building wall or workstation at peninsula bench assemblies.

1.6. REFERENCE STANDARDS

A. Scientific Equipment & Furniture Association (SEFA)
1. SEFA 2.3 -1997 Scientific Laboratory Furniture And Equipment
2. SEFA 3 -1996 Work surfaces
3. SEFA 7 -1996 Laboratory And Hospital Fixtures

B. American Society for Testing and Materials (ASTM)
1. A240-Heat Resistant Chromium and Chromium - Nickel Stainless Steel Plate, Sheet, and Strip for pressure Vessels
2. A312-Seamless and Welded Austenitic Stainless Steel Pipe
3. D570-Water Adsorption of Plastics
4. D695-Compressive Properties of Rigid Plastics
5. D790-Fluctural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
6. E84-Test Method for Surface Burning Characteristics of Building Materials

C. Builders Hardware Manufacturers Association (BHMA)

D. National Electrical Manufacturers Association (NEMA)

E. American National Standards Institute (ANSI)
1. A135.4-Basic Hardboard
2. A208.1-Wood Products

F. American Plywood Association (APA)

G. National Particleboard Association (NPA)
1. NPA 8-Voluntary Standard for Formaldehyde Emission from Particleboard

H. United States Department of Commerce, Product Standard (PS)
1. PS 1-Construction and Industrial Plywood

2. PS 51-Hardwood and Decorative Plywood

I. Architectural Woodwork Institute (AWI)

J. Architectural Woodwork Quality Standards, Guide Specifications, and Quality Certification Program, 6th Edition, as modified by the Drawings and Specifications.

1.7. QUALIFICATIONS

A. Submit a statement of qualification showing adequate experience in manufacturing laboratory casework of the type and scope called for with bid. The statement of qualification shall include a list of at least five (5) comparable installations of similar size and scope. Failure to submit this statement of responsibility and ability to produce may be sufficient grounds for rejection of the bid.

B. Laboratory casework and equipment shall represent the result of the latest engineering practices combined with skilled craftsmanship and modern machinery in order to provide equipment of the latest design and best construction.

C. Indicate any change in corporate ownership within the last five (5) years.

1.8. SUBMITTALS

A. Refer to submittal section of specification for requirements and procedures. Fabrication or purchase of any items prior to approval will be at the vendor's own risk.

B. Equipment Samples.

1. Laboratory furniture vendor shall submit the following samples for approval by the Owner's Representative:

a. One (1) 30" wide full height add-a-drawer base cabinet (refer to drawings BHC.30) adjustable half/full depth shelf and related hardware (pulls, hinges, etc.).
b. One (1) 60" in length x 30" deep table, all with specified finish.
c. One (1) 24" long standard, and one (1) end bracket, with specified finish.
d. Service Fixtures: one of each fixture type required for project.
e. Adhesives and sealants.
f. Countertop material (one of each specified): 12"x12"x1" thick.

2. Approved equipment samples will be retained by the Owner's Representative.

C. Stain and Finish Samples for Wood Components.

1. Stain for casework and miscellaneous items shall be selected by Architect from not less than ten (10) standard manufacturer's samples. The laboratory furniture manufacturer shall furnish stain and finish samples on same material from which the casework and miscellaneous items will be constructed for approval before fabrication of casework starts. Samples shall be clearly identified.
2. Stain and finish samples will be retained by the Owner's Representative.

D. Color and Finish Samples for Steel Components.
   1. Color for casework and miscellaneous items shall be selected by Architect from not less than ten (10) standard manufacturer's colors. The laboratory furniture manufacturer shall furnish color and finish samples on same material from which items will be constructed for approval before fabrication of casework starts. Samples shall be clearly identified.
   2. Color and finish samples will be retained by the Owner's Representative.

E. Shop Drawings. Fabrication or purchase of any equipment prior to approval will be at the manufacturer's own risk. The laboratory furniture manufacturer shall furnish shop drawings showing enclosures, cabinets, hardware, service lines complete with numbers and names of items and details including construction kinds and gauges of materials for hood, cabinets, benches and other items necessary to complete the work. In addition, it is the responsibility of the furniture manufacturer to flag any deviations in dimension, material, detail, etc. that is not exactly the same as shown on the contract documents. Those deviations not flagged will be considered "not approved" even if missed during the approval process and will have to be changed even as late as the installation stage. Provide (1) set for review and comment.

1.9. DEVIATION FROM DRAWINGS AND SPECIFICATION

A. It must be distinctly understood that such deviations shall be subject at all times to written approval prior to receipt of bid. If no written communication is received prior to receipt of bid and approval indicated in a bulletin, it is assumed that bidder will be in total compliance with specifications and will be held responsible for default or delay regardless of any statement to the contrary in their written proposal.

B. Requests for a variance must be made directly to the Owner's Representative's office for consideration no later than fifteen (15) working days prior to bid receipt date.

C. Requests for a variance following the bid opening will be rejected.

D. Variances approved prior to bid date will be handled as a bulletin and be sent to all bidders.

1.10. WARRANTY

A. Furnish a written warranty that Work performed under this Section to be and remain free from defects as to materials and workmanship for a period of three (3) year from date of acceptance. Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner. Defects include, but are not limited to:
   1. Ruptured, cracked, or stained coating
   2. Discoloration or lack of finish integrity
   3. Cracking or peeling of finish
   4. Delamination of plastic laminate or edge banding
   5. Slippage, shift, or failure of attachment to wall, floor, or ceiling
   6. Weld or structural failure (visible weld marks)
   7. Warping or unloaded deflection of components
   8. Sealant (caulking) deterioration, shrinkage, or failure

1.11. TESTING

A. The laboratory furniture vendor shall be required to include in their initial submittals, certified test reports on their laboratory casework finish and work top materials to be furnished and confirmation of load performance for movable tables. The material test reports shall be performed by an independent nationally recognized testing laboratory and shall certify that the materials to be supplied will conform to the requirements of these specifications as well as testing procedures. Failure to include these test reports with the bid might be cause for rejection of the bidder and of the bid proposal.

1.12. FIELD MEASUREMENTS

A. It is the laboratory furniture manufacturer's responsibility to verify field measurements and that equipment will fit through entryways, corridors and door openings enabling a smooth flow of equipment to its proper location in the building. Wall-to-wall counter tops to be installed with a maximum 1/4" gap.

PART 2 PRODUCT

2.1. ACCEPTABLE MANUFACTURERS

A. Although listed herein, the sighting of the following manufacturers does not in any way relieve them of their obligation to build the laboratory furniture in strict accordance with this specification. Interested manufacturers will submit samples in accordance with the requirements included herein 10 calendar days prior to receipt of bid.

B. Acceptable Manufacturers.

1. Wood Casework
   a. Valley City Manufacturing Company (Ontario, Canada).
      Hamilton Laboratory Workstations (Two Rivers, WI).
   b. Kewaunee Scientific Inc. (Statesville, NC).

2. Thermoset Resin Casework [Vivariun]
   a. NuLab furniture Corporation (Englishtown, NJ).
   b. Valley City Manufacturing Company (Ontario, Canada).
   c. Hamilton Laboratory Workstations (Two Rivers, WI).
   d. Kewaunee Scientific Inc. (Statesville, NC).

C. The naming of a manufacturer and designation of a product is for purpose of identifying and describing required product and not to limit competition. Other manufacturers capable of producing the same appearance and having the same quality, durability, and performance may be proposed for use on this project subject to approval of Owner's Representative.

2.2. CASEWORK RELATED MATERIALS

A. General Conditions. Materials used in the construction of laboratory casework and equipment shall be the best of their respective kinds and shall be selected for their

specific applications. Methods of construction shall be of proven designs and conform to the latest and best practices for production of durable, rugged corrosion-resistant laboratory casework and equipment.

B. Steel. Sheet steel used in the construction of laboratory casework and equipment shall be cold rolled steel except as noted. Steel sheets shall be prime quality, three pass cold rolled, patent beveled and resquared. Gauges shall be U.S. standard and shall be selected to develop structurally the required strength and rigidity for each component part. Only bonderized steel with epoxy or urethane powder coating is acceptable.

C. Stainless Steel.

1. Counter tops, sinks, stainless steel furniture, shelves and shelf supports noted on drawings as "Stainless Steel" shall be type 302/304, austenitic chromium nickel stainless steel in accordance with A.I.S.I. specification containing 8% nickel and 18% chromium. Where noted as such, stainless steel furniture and shelf supports shall be constructed exactly as those fabricated of cold rolled sheet steel and the same gauges. Exposed surfaces shall have #4 finish.
2. Counter tops and sinks noted on drawings as "Type 316 Stainless Steel" shall be type 316 stainless steel, similar to type 302/304 except molybdenum is added to improve the general corrosion and pitting resistance over that of type 302/304.

D. Glass. Glass for hinged glazed doors shall be the same material.

E. Solid Hardwood. Solid hardwoods shall be properly air-dried, then kiln dried to 5% to 6% moisture content, and then tempered in inside storage to moisture content of 6% to 8%. Wood used in interior construction to match exterior in species, finish and grade.

F. Lumber Core.
1. Lumber core shall be balanced 5-ply construction consisting of a solid hardwood stave core, hardwood cross plies, and face veneers of 1/42"-1/50". Lumber core shall conform to ANSI/HPMA HP 1983 product standards.
2. Acceptable option to Lumber Core for doors: 45 lb. Particleboard banded on vertical edge of the hinge side with 1-1/2" solid hardwood. Door shall be cross banded with face veneers of 1/42-1/50".

G. Plywood. Plywood shall be veneer core construction glued with water resistant resin adhesives. Hardwood plywood's for exposed surfaces shall have face veneers of selected hardwood species and shall conform to ANSI/HPMA HP 1983 product standards. Plywood for interior and unexposed surfaces shall be hardwood plywood's conforming to U.S. Department of Commerce Voluntary Product Standard PS-1. Interiors of wall mounted cabinets and tall (7' or greater) floor mounted storage cases, regardless of door type or material shall be considered exposed surfaces.

H. Particleboard. Particleboard to be of 45lb. density, and balanced construction with moisture content not to exceed 8%. Particleboards shall meet or exceed the requirements for its type and classification under Commercial Standard CS-236-66, Federal Specifications LLL-B-800A, and ASTM D 1037-78. Particleboard shall meet the following performance requirements. Submit compliance data from the manufacturer prior to fabrication:

1.	Screw holding, Face	225 lbs.
2.	Screw-holding Edge	202 lbs.
3.	Modulus of Rupture	2,103 psi.
4.	Modulus of Elasticity	326,300 psi
5.	Internal Bond	65 psi.
6.	Surface Hardness	900 lbs.

I. Hardboard. Hardboard shall meet or exceed Commercial Standards CS-251 and Federal Specifications LLL-B-00810. Untempered hardboard 1/4" thick smooth exposed side.

J. Thermoset Resin. Where indicated on drawings as "Thermoset Resin Casework" board material shall equal to Trespa Corporation, Poway, CA. Thermoset Resin board material shall consist of layers of phenolic impregnated kraft papers that are compressed in a flat press at pressures exceeding 100 psi and at 300 deg. F (149 deg. C). The top surface layer shall contain the required color pigmentation. The material shall meet the following requirements:

1.	Density:	85.9 lb/cuft
2.	Surface Hardness:	85-95 Rockwell D Scale
3.	Flexural Strength (ASTM D-790):	22,000 PSI Machine Direction
4.	Abrasion Resistance (NEMA LD3-3.01):	1400 Cycles
5.	Flame Spread Index Surface Burning (ASTM E-84-UL723):	30
6.	Flame Spread Index Radiant Heat Source (ASTM E-162):	17

2.3. COUNTER TOPS AND CURBS

A. General Conditions. Counter tops shall be 1" thick. Curbs shall be ¾" of the same material as the counter top and shall be provided at the rear of worktops and on end returns. Laboratory counter tops, shall be epoxy resin unless otherwise noted on the drawings. Epoxy and stainless steel counter tops to be installed without field cutting or drilling. The gap between the curb and wall is to be sealed with silicone sealant, color matched to the counter top. Sink counter tops shall be one piece and have a marine edge around the four sides to create a dished top. Counter tops shall be cut to maximum lengths possible.

B. Epoxy Resin. Epoxy resin counter tops, curbs shall be molded from a modified epoxy resin especially compounded and cured to give optimum physical and chemical resistant properties. Material shall be a uniform mixture throughout the full thickness. Materials shall be non-glaring and black in color unless, otherwise noted on the drawings. Counter tops shall be provided with drip grooves on the underside of exposed edges. Exposed edges shall have a 1/8" radius on front top edge and at vertical corners. Curbs shall typically be 4" high, unless otherwise noted on Drawings, and shall be 3/4" thick bonded to the surface of the top to form a square joint. Epoxy resin tops shall be 1" thick. Joints between tops shall be smooth, even, 1/16" maximum and shall be watertight by use of a silicone adhesive with corrosion-resistant quality. Epoxy resin counter tops and curbs shall be manufactured by: Durcon Inc (Plymouth, MI), Epoxyn Products (Mountain Home, AR) or Laboratory Tops Inc. (Taylor, TX).

C. Stainless Steel. Counter tops, curbs and integral sinks noted on drawings as "Stainless Steel", (type 302/304) or "Type 316 Stainless Steel", shall be constructed of 16-gauge stainless steel. Exposed surfaces shall have #4 finish. Stainless steel counter tops shall be constructed with raised front rim, marine edge construction. Top surface, rear curb and rear or top edge shall be one piece without seams or joints. The top of the 4" high curb shall be chamfered 45 degrees. The joint where the rear curb meets the counter top shall be integral and slightly radiused. Carbon steel or stainless steel shall be welded to the underside in at least three locations along the length to prevent twisting, oil canning, or buckling of surface. The underside shall receive a coat of sound deadening material but not surfaces exposed to view. Stainless steel counter tops shall be 1" thick. Tops shall be as long as practical to permit access to building and room. Field joints shall be provided to join oversized tops with welded channels and angles with bolting arrangements for pulling tops together to produce a hair-line (maximum 1/64") waterproof seam. Where sinks are shown on drawings, they shall be integral and of the size specified. Tops shall be adequately reinforced to accept sinks. Seams and joints shall be welded, ground smooth and polished. Stainless steel tops shall be provided in in locations as designated on the drawings.

2.4. ADJUSTABLE SHELVES

A. General. Adjustable shelves shall be constructed of one of the following as indicated on the Drawings:

1. Wood. Shelves shall be constructed from 1" 9 ply plywood with 1/8" hardwood edge banding on front and back edge only.
2. Stainless Steel. Stainless steel with 1" channel shaped flanges at the sides, front and back.

B. Adjustable shelves shall be 12" deep and 15" deep, as noted on the Drawings.

C. Adjustable shelves shall be mounted to standards (wall condition) or slotted studs (above peninsula benches). Brackets fabricated by the laboratory furniture manufacturer in accordance with the Drawings shall support adjustable shelves. Brackets shall be cold rolled steel with powder-coated finish. Shelves shall be fastened to brackets with two stainless steel screws per bracket.

2.5. SINKS

A. Epoxy Resin. Epoxy resin sinks shall be a solid molded mass consisting of a modified resin, coloring and proper fillers producing a smooth finish the same color as the surrounding counter top, highly resistant to laboratory chemicals, abrasion and water absorption. The side of the sink shall be tapered and the inside corners radiused. Epoxy resin sinks shall have integral side mounted overflows. The bottom of the sink shall pitch to the drain. Sinks shall be manufactured by: Durcon Corporation (Plymouth, MI), Epoxyn Products (Mountain Home, AR) or Laboratory Tops Inc (Taylor, TX).

B. Stainless Steel. Stainless steel sinks shall be constructed of 16 gauge, #4 finish on exposed surfaces. Sinks shall have interior coved corners with bottoms pitched toward drain. Stainless steel sinks shall have integral side mounted overflows. Standard stock sized sinks shall be deep drawn from a single sheet. Other sinks shall be fabricated

having continuous heliarc welded joints ground and polished smooth. The type of stainless steel used to fabricate integral sink to be the same as that used in adjacent counter top (either type 302/304 or 316). Sinks placed in stainless steel counter tops shall be welded in and seams shall be ground smooth and polished to match the counter top finish. Those mounted in plastic laminate or wood tops shall use self-rimming design. Those mounted in epoxy resin tops shall be installed in the same manner as epoxy resin sinks

2.6. SECTIONAL UNIT CONSTRUCTION: WOOD CASEWORK

A. General.

1. Casework shall be fabricated as sectional units, ready for placement in the laboratory as a complete integral rigid unit permitting relocation at any subsequent time. Equivalent to AWI Section 01600-Division A-Wood Cabinets or WIC Section 14 Laboratory Grade, Type 1. Component parts of the unit shall be manufactured ensuring uniformity, interchangeability and accurate alignment. No staples will be permitted to be used as fasteners on any cabinet components. All base cabinets to have integral enclosed bases. Veneers on surfaces of doors, drawer heads, cabinet sides, and other exposed surfaces shall be grade AA yellow birch flat cut. Cabinet interior shall be rotary cut birch.
2. Door and drawer heads within the same cabinet shall be cut and vertically matched from the same sheet of veneer.
3. Cabinet construction shall meet AWI, Style A, frameless, with Type 2 Solid Banding door, Flush Overlay requirements and specifically meet the following tolerances:

    a. The gap between doors, drawers and pull out boards shall be consistently straight and not exceed 1/8".
    b. It is intended that the vertical gap between door and drawer head between adjacent cabinets shall not exceed 1/8". These criteria will require the doors and drawer heads is no further than 1/16" from the exterior vertical edge of the cabinet.
    c. To achieve these tolerances, the hinge must be countersunk into the door side.
    d. Wall cabinets with hinged doors shall meet the same gap tolerances as base cabinets.

4. Sectional units to be located on the laboratory floor shall be equipped with leveling devices easily adjustable from within the units, to compensate for unevenness in the laboratory floor. Access to leveling bolts shall be through holes in the cabinet bottoms directly above the leveling bolts. These access holes shall be provided with removable snap-on covers.
5. Shelves located in cabinets: base, wall, floor shall be edge banded on front and back edges. Where split shelves are required, front and back edges of each shelf component shall be edge banded.

B. Cabinet Construction.

1. Units, except cabinets with non-marring glides, shall have backs with removable panels for access to the pipe spaces at the rear of the units. Removable panels shall be provided in sides of units where units occur in the corners of the rooms and access is required to the pipe spaces. These removable panels shall be designed to permit removal through the fronts of the units and no intermediate rails between drawers are required.
2. The base cabinets shall be designed with solid ends, backs, doors, and drawers and fully enclosed toe space-protecting interiors against dust and vermin. End panels shall be 3/4" 7-ply veneer core plywood with front exposed edges of panels faced with 1/8" solid hardwood. End panels shall be glued to horizontal frame units and to solid bottom panels. Joint construction shall be blind, not extended to face of cases. Joinery utilizing blind mortise and tendon, multiple dowel, or stopped tongue and grove shall be acceptable. Fixed backs on mobile shall be 3/4" 7-ply veneer core plywood, doweled or rabited into end panels and are to be considered an exposed surface. Removable backs shall be 1/4" hardboard. Cabinet backs shall be removable from inside the cabinet without the use of tools. Provide 1" x 1" cleats, top, bottom, and sides, at the rear corners of cabinet to fasten removable panel Cupboard bottoms shall be 3/4" plywood with exposed edge faced with 1/8" solid hardwood providing a flush interior for ease of cleaning. The cupboard interior shall be considered exposed for the sake of material selection and finish. Lock security panels shall be 3/16" tempered welded fiber fitting into an integral groove within the intermediate frame units. Shelves shall be made of ¾" plywood with exposed edge faced with 1/8" solid hardwood. The shelves shall be full depth adjustable type split to provide a combination full and half depth adjustability. Toe spaces shall be nominally 3" deep and 4" high, fully enclosed and integral part of the case. Minimum horizontal frame member sizes, where required, are as follows:

    a. Top Horizontal:
       Front and Rear: 2-1/2" x 1" Hardwood
       Side: 3/4" x 1-1/2" Hardwood
    b. Intermed. Horizontal:
       Front and Rear: 1-1/2" x 3/4" Hardwood
       Bottom: 3/4" plywood with exposed edge faced with 1/8" solid hardwood providing a flush interior.

3. Wall cases shall be integrally constructed to provide a fully enclosed unit designed to ensure a dust and vermin free interior. End panels shall be 3/4" plywood with exposed edges faced with a minimum of 1/8" solid hardwood. Tops and bottoms shall be 1" plywood with exposed front edges faced with 1/8" hardwood. End panels shall be glued to top and bottom panels through blind mortise and tendon or doweled joints. Further reinforcement through screws, cleats, and hot glue shall be provided as required. Backs shall be 3/4" hardwood plywood, rabbited or doweled into end and bottom panels and further secured through the use of glue. Backs to be flush, not recessed and not to exceed 12" in overall depth as indicated on the Drawings. Surfaces, inside and out, are to be considered an exposed surface in terms of material selection and finish. The interior of the case shall be completely flush for ease of cleaning. Shelves shall be 1" plywood with front and back edge faced with 1/8" solid hardwood, and fully adjustable on a minimum of 2" centers.

4. Floor mounted tall storage cases, 48" and higher, shall be integrally constructed to provide a fully enclosed unit designed to ensure a dust and vermin free interior. End and bottom panels shall be 3/4" plywood with exposed edges faced with 1/8" solid hardwood. Top panels shall be 1" plywood with exposed front edge faced with 1/8" solid hardwood. End panels shall be glued to top and bottom unit through blind mortise and tendon or doweled joints. Further reinforcement using screws, cleats, and hot glue shall be provided as required. Shelves shall be 1" 9-ply veneer core plywood with front and back edge faced with 1/8" solid hardwood, and fully adjustable on 2" centers. Backs shall be 3/4" hardwood plywood, rabbited or doweled into end panels, top, and bottom. The cabinet surfaces, inside and out, are to be considered an exposed surface in terms of material selection and finish the interior of the case shall be completely flush for ease of cleaning. Toe spaces shall flush and, fully enclosed and an integral part of the case.
5. Doors shall be 3/4" thick, five ply lumber core with hardwood veneer faces. Swinging doors to 48" high shall be hinged with two hinges per door. Doors over 48" high shall have three hinges per door.
6. Glazed doors shall have machined openings in door opening as above. Glass shall set into doors from rear and shall be held in place by resilient plastic molding. Door operation, hinged or sliding, shall be identical to doors above.
7. Drawer fronts shall be 3/4" thick, five ply lumber core with hardwood veneer faces. Drawer fronts shall be attached to drawer boxes with screws. Sides, backs and fronts of drawer boxes shall be ½" 9 ply or solid hardwood. Drawer box fronts shall be dove tailed and glued to side members. Back members of drawer boxes shall be dadoed into the side members, glued and pinned. Bottoms shall be 1/4" hardboard coated with white vinyl grooved into box front, back and sides. Drawer bottoms shall be further secured with hot glue flowed into the bottom retention groove from the underside around the full perimeter thus forming a rigid and unitized drawer box. Interior of drawer body and its components shall be considered exposed for finishing purposes.
8. Movable Tables. Movable tables shall be constructed as indicated on the Drawings. Movable tables shall have 2" front apron and 6" sides and back. It shall have 1" x 1" tubular stainless steel telescoping legs concealed within each wood table leg and fitted with a 1-1/2" diameter adjustable non-marring floor glides with 1" micro-adjustment capability. Fifty percent (50%) of the moveable tables shall have the ability to be adjusted in height from 31" to 37" in 1" increments inclusive of 1" thick counter top. Movable tables shall be installed at 36" height or as indicated on Drawings. Fixed wood section of leg shall be set at height appropriate for a 31" high table top and adjustable portion of leg shall be stainless steel, drilled at 1" increments, and concealed within each wood table leg. Load capacity of tables shall be 1,000 lb. uniformly loaded and support a 250 lb. concentrated load at midspace with deflection not to exceed 1/8". .

2.7. SECTIONAL UNIT CONSTRUCTION: THERMOSET RESIN CASEWORK

A. General.

1. Construction and design shall develop maximum strength and rigidity in each sectional unit. Each sectional unit shall be completely fabricated ready for placement in the laboratory casework and equipment assembly and shall be a

complete integral rigid unit in itself to permit relocation at any subsequent time. Component parts of the sectional unit shall be jig assembled for accurate alignment insuring uniformity and interchangeability. The entire cabinet shall be fabricated of Thermoset resin.

2. The cabinet shall incorporate the over face design in which posts and rails are concealed behind the doors and drawers. Doors and drawer heads shall create a .125 horizontal and vertical reveal at end of each cabinet.
3. Sectional units to be located on the vivarium floor shall be equipped with leveling devices easily adjustable from within the units, to compensate for unevenness in the laboratory floor. Access to leveling bolts shall be through holes in the cabinet bottoms directly above the leveling bolts. These access holes shall be provided with removable snap-on covers. Cabinet shall be equipped with a screw type polystyrene leveling device in each corner accessible from within the cabinet. Access holes shall be capped once leveling activity is completed.
4. Base cabinets to be constructed to achieve an industry standard height of 37", including the 1" counter top, without raising the cabinet off the floor beyond the height required for normal leveling conditions (1" nominal).
5. Each cabinet shall be of assembled incorporating mortise and tendon construction. Vertical and horizontal members shall be keyed and then phenol seal bonded and mechanically fastened. Exposed edges on cabinet components, doors and drawer heads shall be sanded and polished to a satin smooth finish. Underside and toe space shall be enclosed.
6. Component Thickness Schedule:

a.	Cabinet sides and bottoms:	0.5"
b.	Door and drawer heads:	0.5"
c.	Horizontal Rail Supports:	1.0"
d.	Cabinet Backs:	0.125"
e.	Wall Cabinet Backs:	0.125"
f.	Cabinet Shelves:	0.75"

7. Component Color Schedule:

a.	Cabinet Exterior:	Color to be selected by Architect
b.	Cabinet Interior:	White
c.	Drawer Interior	White
d.	Drawer Exterior	White
e.	Thermoset Resin Material Edging:	Black
f.	External Door Surface and Drawer Head:	Color to be selected by Architect.

8. Exposed edges on all cabinet components shall be rounded and polished smooth.

B. Drawer and Cupboard Units.

1. Each unit shall consist of drawers or cupboard or a combination thereof as shown and shall harmoniously fit into the laboratory assembly. Units, unless otherwise specified, shall have backs with removable panels from the inside, for access to the pipe spaces at the rear of the units. Removable panels shall be provided in sides of units where units occur in the corners of the rooms and access is required

to the pipe spaces. These removable panels shall be designed to permit removal through the fronts of the units.

2. Cupboards in which sinks are mounted, shall be provided with removable bottoms.
3. Cupboard shelves shall be split to allow for either full or half depth adjustable shelves.
4. Sectional units shall have 4" high by 3" deep toe space members, unless otherwise noted on drawings.
5. Access to the leveling bolts shall be through holes in the cupboard bottoms directly above the leveling bolts. These access holes in the cupboard bottoms shall be provided with removable snap-on covers.

2.8. HARDWARE AND ACCESSORIES

A. Door and Drawer. Door and drawer pulls shall be 6" wire type, satin chrome plated finish. Drawer pulls shall be installed horizontally; door pulls shall be installed vertically. Wall cabinet and floor storage cabinet pulls should be located for reaching convenience.

B. Hinges.

1. Hinges on wood cabinets shall be grade #1, exposed axle, zinc die cast and satin chrome plated finish by Hafele Aximate #34452101, Grass #950 or Hettich #4000-180T22-11M. Hinge shall be capable of supporting a 150 lb. dynamic load, 100 lbs on each side of the door located 12" from the hinge.
2. Hinges on Thermoset Resin cabinets shall be fabricated of steel and plated with zinc. It shall be 3" high, totally concealed, self-closing type with a 150-degree swing.

C. Door Catches. Catches shall be provided on hinged doors and shall be spring-loaded nylon roller types.

D. Leg Shoes. Leg shoes shall be pliable 2.5" high, coved to the floor at the bottom and shall be cemented tightly at the floor with clear silicone sealant.

E. Toe space filler. At gap created between the cabinet or ledge static panel and the floor due to leveling conditions, mechanically fasten (flat head screw) a 4" wide 18 gauge galvanized steel plate to the cabinet behind the base molding to support its application. Provide continuous clear silicone sealant at intersection of floor/wall and steel plate.

F. Drawer Slides. Drawer slides shall be ball bearing, full extension zinc plated assembly that will allow the drawer body to be completely exposed and physically accessible. Drawer slides shall have an integral stop mechanism to avoid inadvertent removal. Assembly shall be rated for 100-pound dynamic load and manufactured by Precision Slide, Accuride or Waterloo.

G. Shelf Adjustment. Adjustable shelf support clips inside wall, floor and base cabinets shall be designed for adjusting shelves on 2" centers and shall be nylon. Clip shall be configured to clamp top and bottom of shelf to avoid movement. Clip may have one or two pins. In addition to shelf clips required for initial assembly, six (6) dozen additional

clips to be provided to the owner. Cupboards to have combination half/full depth adjustable shelf.

H. Locks. Locks to be furnished on all workstation cabinets and where noted on the Drawings. Drawer and door locks shall be solid brass, five-pin tumbler type having paracentric keys. The exposed face shall be chromium plated with satin finish. Locks shall be mounted in special housing so designed as to prevent removal when in locked position. The locks and lock housings shall be fully concealed within the drawer heads and doors. The lock tongues shall engage the rails or stiles when in locked position. Install theft panels between each drawer or cupboard segment in order to isolate locked section. Locks shall be separately keyed (including cabinets with multiple locks and cabinets in the same room) and two (2) keys shall be furnished with each lock. Supply two (2) master keys for all locks.

I. Standards. Wall mounted adjustable shelves and pegboards shall be mounted to twin-tracked standards. Standards shall be coated with an epoxy powder coating and a nominal cross section of 1-1/2" x 1/2". Acceptable manufacturers shall be Reeve, Fixture Hardware Manufacturing Corporation, and Knape and Vogt. Standards and slotted studs shall have a fully compatible slot pattern. Fasten standards to concrete masonry walls or properly blocked steel studded walls with appropriate flat head screws. Adjustable shelves, wall cabinets and pegboards will be furnished with integral mounting brackets or clips.

J. Slotted Studs. Adjustable shelves, wall cabinets and peg boards mounted above peninsula or island benches shall be mounted to double-sided, twin-tracked studs. Slotted studs shall be fabricated of 14 ga. fully welded steel tube and be coated with an epoxy powder coat. Acceptable manufacturers shall be Reeve, Fixture Hardware Manufacturing Corporation, and Knape and Vogt. Slotted studs and standards shall have a fully compatible slot pattern. Adjustable shelves, wall cabinets and pegboards will be furnished with integral mounting brackets or clips.

2.9. MECHANICAL SERVICES

A. Mechanical service fixtures shall be heavy duty, specially designed and manufactured for laboratory use and shall have provisions for index coding. Fixtures for liquids and gaseous mixtures shall have lettered and colored indexes for each service. Handles shall be black plastic bonnet type with color tabs identifying utility. Serrated hose ends shall have seven (7) serrations. Fixtures for gas, air and vacuum shall be laboratory ball valve. Water fixtures shall be compression type. Drain fittings shall be polypropylene unless otherwise noted. Fixtures that serve special gases (N2, O2, NO2, etc.) and instrument air shall be lubricated, cleaned, capped, protected, and delivered certified for "Oxygen" service.

B. Plumbing Fixtures. Plumbing fixtures, except for drain fixtures and fittings, shall be a red-brass composition containing at least 85% copper with washers and seats, of maximum wear resistant materials for the specific use. Reagent grade water fixture to be brass gooseneck type with an internal polypropylene lining that permits recirculation to the manual outlet.

C. Needle Valves (Large). Large needle valves contain a replaceable valve seat and floating cone made of stainless steel for fine control. Valves have removable serrated hose end.

D. Compression Water Valves. Compression water valves have a renewable unit containing all working parts, including a stainless steel replaceable seat and valve disc. This unit is broached on the outside for permanent position in the valve body. The unit contains an integral control device for volume of water discharged by the faucet. The valve has a removable serrated hose end unless otherwise noted. Valve shall be rated for 125 psi operating pressure with a max. of 190 psi for intermittent use.

E. Faucet Accessories. Cup sink and reagent grade water faucets to have serrated hose ends. Faucets are to be swivel type except reagent grade water.

F. Vacuum Breakers. Integral vacuum breakers shall be supplied on domestic water fixtures. The fume hood fixture shall have the vacuum breaker exposed 7 ft A.F.F. on face of hood (exposed vacuum breaker and piping to have same finish as other fixtures). The vacuum breaker for the eye wash fixture shall be located under the sink cabinet, visible when the cabinet doors are open. Engineer to confirm code compliance.

G. Service Identification. Index buttons mounted in fixture handles shall identify the following services. Buttons shall be color-coded and lettered.

1.	Hot Water	HW	Red
2.	Cold Water	CW	Green
3.	Gas	GAS	Blue
4.	Air	AIR	Orange
5.	Vacuum	VAC	Yellow
6.	Reagent Grade Water	RG	White
7.	Carbon Dioxide	CO2	Pink

H. Fixture Hardware. Fixtures are to be supplied with necessary tank nipple and lock nut to attach to counter top, curb or panel.

I. Service Fixture Finish. Laboratory brass service fixtures shall be ground smooth, satin chrome plated finish with a clear epoxy coating. Fixtures receive multiple applications of coating and are baked for polymerization. Units must be assembled before coating and pressure tested before shipment.

J. Fixture Shipment. Fixtures shall be assembled in factory and supplied loose.

K. Approved Manufacturers. Service fittings shall be manufactured by Water Saver Corporation.

L. Hand Held Eye Wash: Where indicated with designation "EW" on floor plans, provide a dual head eye wash assembly, 6ft length of rubber hose, counter top mounting stand, slip ring mechanism to allow for hands free operation and in-line vacuum breaker. Unit's finish to match other service fittings.

M. Safety Showers: Safety showers that are noted on drawings as SS1 will include mixing valves.

2.10. SINKS

A. Sink Supports. Epoxy sinks and stainless steel sinks mounted in epoxy resin tops, shall be supported on steel channels attached to the ends of sink cabinets and adjustable by screw type rods to insure tight fit to the underside of the table with a water-proof compound.

B. Sink Outlets, Tailpieces and Overflows. Sink outlets and tailpieces for epoxy sinks shall be supplied under this section and shall be polypropylene. Sinks shall be equipped with an integral overflow that is connected directly to the tailpiece. Overflow shall consist of an outlet located 2" below counter top and 1/2" diameter tygon tubing to connect overflow to tailpiece which shall be modified to accept tubing.

C. Traps. Furnished under Division 15 Mechanical.

2.11. PEGBOARDS

A. Pegboards shall be fabricated of 1" thick, epoxy resin. All surfaces to be polished, edges radiused 1/8", and the color shall be black throughout laboratories and stainless steel in the vivarium. Pegboards shall be furnished with removable rounded-tip black polypropylene pegs, stainless steel drip trough, 1/4" diameter drip trough outlet and flexible black, rubber tubing between drip trough outlet and sink (cut as required). Pegboard size and configuration shall be as indicated on the Drawings.

2.12. ELECTRICAL FIXTURES

A. General. Electrical fixtures shall be 1/60/115V 20A or 1/60/208V 20A as indicated, complete with enclosure boxes, receptacle and cover plates. Cover plates to be stainless steel.

B. Electrical Raceways. Electrical raceways will be supplied and installed under Division 16 Electrical.

2.13. FURNITURE FINISHES

A. Metal Finishes

1. All steel components of the laboratory casework and equipment shall have a baked-on acid, alkali and solvent resistant finish. Prior to the applications of the finishing processes, each unit shall be carefully inspected and made ready for the metal treatment and finishing process. The first step in the treatment is to insure a thorough cleaning and removal of all oil, grease, foreign matter and rust spots. There should be no rust spots. Cleaning is performed either by solvent or by alkaline bath washing and spraying. Hand wiping will not be acceptable. The metal shall then pass through a stage wherein it shall be processed to receive the finished coats.
2. Metal parts shall pass through a paint chamber in which an epoxy or urethane powder coating is applied to all metal items. The coating shall then be baked for an appropriate time cycle to insure complete polymerization.

3. The resultant finish shall be highly resistant to abrasion, acids, alkalis and solvents, and shall be flexible, hard and smooth. The dry-film thickness on any and all parts, in all areas, shall be a minimum of 0.75-1 mil. and without "orange-peel", sags, runs or over spray.
4. Cured films shall be unaffected by 2 ft-lbs impact or 1/2" mandrel bend when supported on 18 gauge steel panel and shall have a pencil hardness of 8H to 9H. The finished product shall have a smooth, hard and flexible finish that has superior resistance to abrasion, corrosion and chemical activity. The polymerized film shall resist the action of the following reagents without any effect other than loss of luster or slight discoloration when subjected to a one cc puddle test for one hour:
   a. Acetic Acid: 1% to glacial
   b. Sulfuric Acid: 25%
   c. Sulfuric Acid: 50%
   d. Sulfuric Acid: 85%
   e. Hydrochloric Acid: 10%
   f. Hydrochloric Acid: 37%
   g. Nitric Acid: 10%
   h. Nitric Acid: 25%
   i. Nitric Acid: 60%
   j. Phosphoric Acid: 85%
   k. Perchloric Acid: 60%
   l. Formaldehyde: 37%
   m. Phenol: 85%
   n. Ammonium Hydroxide Concentrate
   o. Carbon Tetrachloride
   p. Chloroform
   q. Acetone
   r. Xylol
   s. Furfural
   t. Sodium Hypochlorite

B. Wood Finished

1. Exposed surfaces to receive finish shall be free of machine marks, carefully and smoothly sanded in preparation for finishing. Wood with natural finish followed by application of a resinous sealer, dried properly and carefully sanded. Three complete coats of chemical resistant catalyzed vinyl meeting AWI's TR-5 finish shall then be individually applied and allowed to individually dry, resulting in a smooth semi-gloss finish. Drawer boxes shall be sealed with pigmented resinous sealer. Top frames of drawer openings and toe spaces shall be sealed with clear sealer.
2. Chemical resistance testing criteria (Rating A: no effect; B: slight discoloration):

a.	Acetic Acid: 98%	A
b.	Chromic Acid: 60%	B
c.	Formic Acid: 88%	A
d.	Fluorosilicic Acid	A
e.	Hydrochloric Acid: 20%	A
f.	Hydrochloric Acid: 37%	A
g.	Hydrochloric Acid: 49%	B

h.	Hydrogen Peroxide: 6%	A
i.	Nitric Acid: 20%	A
j.	Nitric Acid: 30%	B
k.	Nitric Acid: 40%	B
l.	Phosphoric Acid: 5%	B
m.	Sulfuric Acid: 20%	A
n.	Sulfuric Acid: 33%	A
o.	Sulfuric Acid: 45%	A
p.	Sulfuric Acid: 55%	A
q.	Ammonium Hydroxide: 28%	A
r.	Sodium Hydroxide: 10%	A
s.	Sodium Hydroxide: 20%	A
t.	Sodium Hydroxide: 40%	A
u.	Sodium Hydroxide: 50%	A
v.	Sodium Hydroxide Flake	A
w.	Potassium Hydroxide: 40%	A
x.	Sodium Carbonate: saturated solution	A
y.	Sodium Chloride: saturated solution	A
z.	Sodium Phosphate: 5%	A
aa.	Zinc Chloride: saturated solution	A
bb.	Sodium Sulfide: saturated solution	A
cc.	Acetone	A
dd.	Acetate	A
ee.	Benzene	A
ff.	n- Butyl Alcohol	A
gg.	Carbon Tetrachloride	A
hh.	Chloroform	A
ii.	p- Dioxane	A
jj.	Ethyl Acetate	A
kk.	Ethyl Amyl Ketone	A
ll.	Ethyl Ether	A
mm.	Ethyl Alcohol	A
nn.	Formaldehyde	A
oo.	Furfural	A
pp.	Gasoline	A
qq.	Hexane	A
rr.	Kerosene	A
ss.	Methanol	A
tt.	Methyl Ethyl Ketone	A
uu.	Monochorobenzene	A
vv.	Naphtha	A
ww.	Toluene	A
xx.	Trichlorobenzene	A
yy.	Xylene	A
zz.	Sodium Hypochlorite	A
aaa.	Glycerin	A
bbb.	100 hour water contact	A
ccc.	5 minute boiling water contact	A

3. Impact resistance test. No cracks or crazing in the finish film is acceptable when an 18" crossbar, 3/4" in diameter and weighing one pound, is dropped onto the finished surface from a height of 36".

2.14. FUME HOOD BASE CABINETS

A. General.

1. Base Cabinets: Base cabinet types for fume hoods shall match adjacent cabinets in material and finish. Doors to be flush type and the hardware shall be lever type handle to assure that all hood base cabinets match in appearance. They shall include the following requirements:

a. Cupsink /Plumbing Access:

1) Cupsink to be housed and installed at rear of fume hood with access through the rear of the flammable service ledge to related plumbing package. Refer to drawings for cupsink location.

b. Acid Storage Cabinet:

1) 1/4" thick white polypropylene lining on interior surfaces.
2) 1-1/2" diameter plastic vent pipe connecting at the rear of base cabinet to the inside hood chamber behind the baffle plate and sealed. Vent pipe to extend 12" above fume hood counter top.
3) Removable back panel.
4) No self-closing or bi-fold doors.
5) Adjustable plastic lined shelf supported with nylon "locking" clips to avoid inadvertent removal. Shelf to be capable of supporting 150 lbs. without deflection.
6) One (1) 1" deep liquid tight drip pan to cover the entire floor area of the lined cabinet compartment. Pan to be fabricated of 1/4" thick white polypropylene with seams heat welded.
7) Fasteners and shelf supports to be plastic. (Non-Corrosive).
8) Apply silkscreen signage, color: red, to cabinet doors indicating "CORROSIVE CHEMICALS".

c. Flammable Storage Cabinet:

1) Conform to NFPA 30 in term of material and construction detail.
2) 1-1/2" diameter stainless steel vent pipe connecting at the rear of base cabinet to the inside hood chamber behind the baffle plate and sealed. Vent pipe to extend 12" above fume hood counter top.
3) Removable back panel.
4) No self-closing or bi-fold doors.
5) Ground (to structure) and bond cabinet.
6) Flame arrestor on cabinet vent outlet.
7) Adjustable expanded metal shelf supported with "locking" clips to avoid inadvertent removal.

8) Apply silkscreen signage, color: red, to cabinet doors indicating "FLAMMABLE - KEEP FIRE AWAY".

2.15. CYLINDER RACKS

A. Furnish and install wall or ledge mounted cylinder racks, designated on the Drawings as "CYLR", constructed as indicated on the Drawings. Cylinder racks shall be fabricated of steel channels as fabricated and supplied by the Unistrut Corporation (Wayne, MI), Kindorf (Baltimore, MD) or Powerstrut. The specific series and gauge required for each component shall be as indicated on the Drawings along with associated accessories. Channels and parts shall be furnished to laboratory furniture manufacturer in a plain state in order to allow them to weld and paint the finished assemblies with their standard acid resistant epoxy powder coat finish. Color to be selected by Architect.

2.16. WALL MOUNTED CASEWORK

A. Where noted as such, provide wall mounted casework that matches all other laboratory casework in design and material. The assembly's construction however, must be modified to withstand the rigors of being mounted directly to the wall and suspended above the floor, without sagging or effecting the door or drawer operation. The assembly must be capable of supporting an equipment load of at least 150 lb. per running foot above and beyond the weight of the assembly.

2.17. CONTROLLED ENVIRONMENTAL ROOM WALL MOUNTED SHELVING

A. Where noted on drawings, provide full height 14 gauge heavy duty rolled steel channel type standards capable of mounting brackets for shelves and counter top at infinite positions. They shall be bolted into blocking located in wall provided by controlled environmental room vendor.

B. Shelving shall be 18 ga. type 304 stainless steel 12" deep and be fabricated with a grid of oblong slots, ¾" x 1 ¾" with 2 ½" lateral spacing to promote ventilation. Each shelf shall be supported with two brackets and be fastened to it.

C. Brackets shall be 12 ga. type 304 stainless steel.

D. Where stainless steel counter top is indicated on drawings, provide an appropriate set of brackets to support it without movement.

PART 3 EXECUTION

3.1. JOB SITE CONDITIONS

A. Carefully examine the installed work of others and verify that such work is complete to the point where this installation may properly commence. Verify that required backing and reinforcements are in place, secure, and accurately located.

B. Proceed with work when conditions permit Work to be installed in complete accordance with the original design, accepted submittals, and the manufacturer's written instructions.

C. In the event of discrepancy, immediately notify the Architect in writing. Do not proceed with the installation in areas of discrepancy until issues have been resolved.

3.2. INSTALLATION

A. Casework shall be located in their designated positions, leveled, and plumbed true and straight by means of the micro-adjustment device located in each bottom corner of the cabinet.

B. Counter top lengths shall be fabricated as specified and indicated on the drawings with ends abutting tightly, and sealed with corrosion resistant sealants. The horizontal surface shall be smooth and level with no raised edges at the joints. Tops shall be anchored to base cabinets.

C. Install miscellaneous filler panels and scribes as required for a continuous tight and accurate fitting installation without gaps or spaces between cabinet work or counters and adjoining surfaces. All back splashes to be sealed at wall surfaces with corrosion resistant sealants.

D. The assemblies listed below are to be fastened together with devices of adequate strength to support cabinet or shelf fully loaded. Fully loaded will be defined as twenty-five (25) pounds per linear foot per shelf for enclosed wall cabinets or open adjustable shelves not inclusive of cabinet, shelf and bracket weight. Securely fasten wall mounted items to solid supporting material only. Installation to meet seismic requirements.

1. Wall cabinet to wall.
2. Adjustable shelf to wall.
3. Pegboard to wall.
4. Wall cabinet to slotted stud
5. Adjustable shelf to slotted stud
6. Pegboard to slotted stud to slotted stud

E. Adjust hardware so that doors and drawers operate smoothly without warp nor binding. Lubricate operating hardware as recommend by manufacturer.

3.3. COUNTER TOP INSTALLATION

A. Counter top lengths shall be fabricated as specified and indicated on the drawings with ends abutting tightly in a hairline joints, single true plane, smooth and level with no raised edges at the joints and sealed with corrosion resistant sealants.

B. Make field jointing in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted submittal drawings. Joints shall be factory prepared requiring no job site processing of top and edge surfaces.

C. Tops shall be anchored to base cabinets. Where work surface is intended to be moveable use a clamping device that is removable. Counter tops to be installed with a maximum 1/8" gap.

D. Provide holes and cutouts as required for equipment and service fittings and fixtures. Verify size of opening with actual size of item to be used, prior to making openings. Form inside corners to a radius of not less than 1/8". After cutting, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a chemical resistant sealer recommended by the manufacturer.

3.4. INSTALLATION OF ACCESSORIES

A. Install in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.

3.5. CLEANING

A. Repair or remove and replace defective or damaged work as acceptable to the Owner's Representative at no change in contract amount.

B. Clean units, including wiping out of drawers and cabinet shelves.

C. Clean counter tops with diluted dishwashing liquid and water, leaving tops free of grease and streaks. Use no wax or oils.

3.6. PROTECTION

A. Protect against soiling and deterioration during remainder of construction period.

B. Protect counter tops and ledges for the remainder of the construction period with 1/4" corrugated cardboard or equal completely covering the top and securely taped to edges. Mark cardboard in large lettering "No Standing".

END OF SECTION 12345

SECTION 12356

CASEWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Laminate-faced kitchen cabinets.
   2. Plastic-laminate countertops and backsplashes.

B. Related Sections include the following:
   1. Division 6 Section "Architectural Woodwork" for custom fabricated cabinets and plastic laminated countertops and backsplashes.
   2. Division 15 Sections for sinks and for plumbing fittings and venting connections of residential appliances installed in casework.
   3. Division 16 Sections for conduit and connections installed in casework for residential appliances.

1.03 DEFINITIONS

A. Exposed Surfaces of Cabinets: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

B. Semiexposed Surfaces of Cabinets: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semiexposed."

C. Concealed Surfaces of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: For the following:
   1. Cabinets.
   2. Plastic-laminate countertops.
   3. Cabinet hardware.

C. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.

D. Samples for Verification: For the following materials; in sets showing the full range of color, texture, and pattern variations expected:
   1. Thermoset decorative panels for cabinet finish, 8 by 10 inches.
   2. Plastic laminate for countertops, 8 by 10 inches.
   3. One unit of each type of exposed hardware.

E. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for construction adhesive, including printed statement of VOC content and material safety data sheets (MSDS).
2. Credit EQ 4.4: Composite wood manufacturers' product data for each composite wood product used indicating that bonding agent used contains no urea formaldehyde.
3. Credit MR 7: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by and FSC-accredited certification body to comply with FSC 12, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.

1.05 QUALITY ASSURANCE

A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.

B. Quality Standards: Unless otherwise indicated, comply with the following standards:
   1. Cabinets: KCMA A161.1.
      a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with the above standard.
   2. Plastic-Laminate Countertops: KCMA A161.2.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

1.07 COORDINATION

A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

B. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.01 CABINET MATERIALS

A. General:
1. Particleboard: ANSI A208.1, Grade M-2.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.

B. Exposed Materials:
1. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
   a. Provide material finished on both sides for doors and drawer fronts.
   b. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
   c. Colors: White.

C. Semiexposed Materials: Unless otherwise indicated, provide the following:
1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces.
2. Vinyl-Faced Particleboard: Medium-density particleboard with vinyl film adhesively bonded to particleboard.
   a. Provide vinyl film on both sides of shelves, dividers, drawer bodies, and other components with two semiexposed surfaces and on semiexposed edges.
   b. Colors, Textures, and Patterns: As indicated by manufacturer's designations .

D. Concealed Materials: Solid wood or plywood, of any hardwood species, with no defects affecting strength or utility; or particleboard.

E. All wood products, project-wide: Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principle and Criteria for wood building components. These components include, but are not limited to, temporary fencing, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.

2.02 CABINET HARDWARE

A. Pulls: Back-mounted wire pulls, US26D.

B. Hinges: Concealed European-style self-closing hinges.

C. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; 75 pound capacity.

2.03 COUNTERTOP MATERIALS

A. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Formica Corp.
   b. Ponite
   c. Wilsonart International.
2. Grade: HGS and HGP; see other Part 2 articles for locations.

3. Grade for Backer Sheet: BKL.
4. Colors, Textures, and Patterns: As selected by Architect from plastic-laminate manufacturer's full range.

B. Particleboard: ANSI A208.1, Grade M-2.

2.04 CABINETS

A. Product:
1. Style: Rutland II, Merillat Essentials; Merillat.
2. Finish: White.
3. Door and Drawer Pulls: 4" wire pulls, US26D, satin chrome.

B. Face Style: Flush overlay; door and drawer faces cover cabinet fronts with only enough space between faces for operating clearance.

C. Cabinet Style: Face Frame.

D. Door and Drawer Fronts: 5/8-inch- thick thermoset decorative panels.

E. Cabinet Frames: 3/4-by-1-1/2-inch solid wood.

F. Exposed Cabinet End Finish: Thermoformed vinyl-faced panels.

G. Cabinet End Construction: 3/8-inch- thick engineered wood panel, 48 lb. density, laminated inside and out with a water and household chemical resistant 2.5 mil solid white color vinyl.

H. Cabinet Tops and Bottoms: 1/2-inch- thick engineered wood panel, 48 lb. density, laminated on two sides with a water and household chemical resistant 2.5 mil solid white color vinyl, fully supported by and secured in rabbets in end panels, front frame, and back rail.

I. Back, Top, and Bottom Rails: Solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.

J. Wall-Hung-Unit Back Panels: 1/4-inch- thick engineered wood panel, 50 lb. density, fastened to rear edge of end panels and to top and bottom rails; panel shall be finished with 2.5 mil solid white color vinyl laminated to the interior side.

K. Base-Unit Back Panels: 1/4-inch- thick engineered wood panel, 50 lb. density, fastened to rear edge of end panels and to top and bottom rails; panel shall be finished with 2.5 mil solid white color vinyl laminated to the interior side.

L. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
2. Subfronts, Backs, and Sides: 1/2-inch- thick engineered wood panel, 48 lb. density.
3. Bottoms: 1/4-inch- thick engineered wood panel, 50 lb. density with vinyl on interior face; inserted into dado in front, back and sides; glued and stapled to sides.

M. Shelves: 5/8-inch- thick engineered wood panel, 48 lb. density, laminated with vinyl on both sides and front edge finished with matching melamine edgebanding.

N. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.

O. Factory Finishing: Finish cabinets at factory. Defer only final touchup until after installation.

2.05 PLASTIC-LAMINATE COUNTERTOPS

A. Configuration: Provide postformed laminate countertops with the following front, cove (intersection of top with backsplash), backsplash, and endsplash style:
1. Front: No drip (raised marine edge with rolled front).
2. Cove: Cove molding (one-piece postformed laminate supported at junction of top and backsplash by wood cove molding).
3. Backsplash: Curved or waterfall shape with scribe .
4. Endsplash: None.

B. Plastic-Laminate Substrate: Particleboard not less than 3/4 inch thick.
1. For countertops at sinks and lavatories, use Grade M-2-Exterior-Glue particleboard or exterior-grade plywood. No joints shall occur within 2 feet of a sink. Sand surfaces to which plastic laminate is to be bonded.
2. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of particleboard laminated to top.

C. Backer Sheet: Provide plastic-laminate backer sheet on underside of countertop substrate.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.

C. Install cabinets and countertop level and plumb to a tolerance of 1/8 inch in 8 feet.

D. Fasten cabinets to adjacent units and to backing.
1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c. with No. 10 wafer-head screws sized for 1-1/4 inch penetration into concealed wood blocking, or hanging strips.
2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c., with toggle bolts through metal backing behind gypsum board.

E. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.
1. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.

2. Seal edges of cutouts by saturating with varnish.

3.02 ADJUSTING AND CLEANING

A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 12356

SECTION 12500

WINDOW TREATMENT

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of window treatment is indicated below. Types of window treatment work in this section:

1. Horizontal blinds for use on exterior windows and interior borrowed lites.
2. Electrical shades.
3. Lab cubicle curtains.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 01 Section "Sustainable Design Requirements"
2. Division 16 Electrical for electrical blinds.

1.2 QUALITY ASSURANCE

A. General: Provide window treatment units which are complete assemblies produced by one manufacturer, including hardware, accessory items, mounting brackets, and fastenings.

B. Furnish materials in colors and patterns as selected by Architect from manufacturer's standard colors / patterns.

1.3 SUBMITTALS

A. Submittals required by this section shall be complete and organized in a clear and concise manner. Incomplete and/or unorganized submittals will not be accepted and will be returned without review.

1. Division 1: Conform to the requirements of Division 1, Section 01300, "Submittal."
2. Product Data: Submit manufacturer's specifications and installation instructions for each type of window treatment unit required. Include methods of installation for each type of opening and supporting structure.
3. Samples for initial selection of color, in form of manufacturers' color charts consisting of sections of exposed components with integral or applied finishes showing full range of colors and materials.
4. Include detailed wiring diagrams and scheme.

PART 2 – PRODUCTS

2.1 HORIZONTAL BLINDS

A. Headrail: Manufacturer's standard headrail consisting of channel-shaped section complete with tilting mechanism, top and end braces, top cradles, cord lock, and accessory items required for type of blind and installation indicated.

B. Bottom Rail: Manufacturer's standard tubular steel bottom rail, designed to withstand twisting or sagging. Contour top surface to match slat curvature, with flat or slightly curved bottom. Close ends with manufacturer's standard metal or plastic end caps, of same color as rail. Finish rail in same color as slats, unless otherwise indicated.

C. Slats: Manufacturer's standard, spring-tempered aluminum slats, nominal 0.008" thick, (louver blades), rounded corners with forming burrs removed, as follows.

1. Slat Width: 1" (25 mm) nominal slats, with other components sized to suit.

D. Ladders: Manufacturer's standard ladder construction designed to support and maintain slats at proper spacing and alignment in open and closed positions, as follows:

1. Braided polyester cord design consisting of vertical components of not less than 0.043; nor more than 0.068" in diameter and integrally braided ladder rungs of not less than 4 threads; space ladders not further than 23" apart and 7" from ends of slats.

E. Tilting Mechanism: Manufacturer's standard assembly including disengaging worm and gear mechanism to eliminate overdrive, low friction gear tilter, drum and cradle at each ladder, tilt rod, tape clips, and grommet guides to prevent wear on ladder and cords; designed to hold slats at any angle and prevent movement of slats due to vibration, operated as follows:

1. Wand Operation: Manufacturer's standard, detachable clear plastic wand, of proper length to suit blind installation, to provide convenient operation, and detachable without tools by raising locking sleeve.

F. Lifting Mechanism: Manufacturer's standard including crash-proof cord locks with cord separators and braided polyester or nylon lift cords with tassel or lift ring at ends. Include cord equalizers of self-aligning type designed to maintain horizontal blind position.

G. Installation Brackets: Manufacturer's standard brackets designed to facilitate removal of head channels. Provide intermediate brackets at spacing recommended by blind manufacturer. Include hardware necessary for secure attachment of brackets to adjoining construction and to head rails. Design brackets to support safely the weight of blind assemblies plus forces applied to operate blinds.

H. Finish: Provide finishes indicated below. Finish exposed accessories and hardware to match rail color. Provide manufacturer's standard corrosion resistant finish to concealed items of hardware.

1. Aluminum Slats: Provide manufacturer's standard factory-applied finish system consisting of chemical conversion coating followed by baked-on synthetic resin enamel finish coat.
2. Color: Milled finish.

2.2 ELECTRIC SHADES

A. Provide window shades and accessories as follows:

1. Shade fabric: Fire resistant, openness factor as specified and required by orientation and glazing.
    a. Single blackout shadeband with side or center channels, concealed fastening with no exposed screws or plugs in the face of the channels.
2. Operation / Electric with the following features:
    a. Group switching.
    b. Manual activation.
3. Mounting: Overhead mounted.
4. Shade orientation: Regular roll, shade cloth falls at window side of roller.
5. Configuration: Single band.
6. Accessories without exposed fastening:
    a. Single fascia: One-piece extruded aluminum.
    b. Extruded aluminum hembar with vinyl light seal.
    c. Blackout side and center channels.

B. Manufacturer: MechoShade Systems, Inc.
Long Island City, New York 11101, USA.

1. ElectroShade electrically operated units.

C. Shade cloth: Shade cloth shall meet requirements of Fed. Spec. CCC-C-521E for fire retardancy, NFPA 701 Small-Scale and/or NFPA 701 Large-Scale requirements. Anti-microbial without topical treatment. NY State Fire-Gas Toxicity Text: LC50 22.5 g. ASTM E-84-90: Flame Spread 17, Smoke Density Index 118, Shade cloth seconds or shade cloth manufactured using reprocessed materials are not acceptable.

1. Shade cloth:
    a. Single blackout shadeband.

D. ElectroShade Motorized System:

1. The motor shall be tubular asynchronous and concealed inside an extruded aluminum tube with asymmetrical channels to which the shade and the mounting spline are affixed. Internal limit switches shall be readily removable without having to remove the motor or the shade-tube assembly.

E. Control System: Manufacturer's standard system customized to project requirements. Multi-zone shade controls and operations as specified.

F. Pockets / Blackout Channels / SnapLoc Fascia

1. Extruded aluminum pocket with exposed tile support and pocket closure with baked-enamel finish.
2. Accessibility by removing closure. No exposed screws or mounting means. Pocket shall be sized for:
    a. Single shadeband.
    b. Front and rear shades (sunscreens and blackout material) side-by-side mounting.
    c. Overlapping shades (two rolls of shade cloth) either high-low or side-by-side mounting for room darkening without center blackout channels.

d. Side and center blackout channels appropriately sized for manual or motorized operation.
e. Extruded aluminum SnapLoc fascia which continuously fits on the end and center brackets as a one-piece section over two or more shadebands.

G. Warranty: Interior Shades: Ten-year warranty on manually operated components, except bead chain which is a maintenance / service item. Ten-year warranty on shade cloth with provision that it will not deteriorate, sag or warp and will remain fit for use for the full warranty period when used as an interior rollershade. MechoShade Systems warrants its hardware components to be free from defects in material and workmanship under the normal and proper use for a period of ten (10) years from date of invoice. Motors and electrical accessories are warranted for five (5) years from date of invoice. Five (5) years for motors and five (5) years for electronic components.

2.3 FABRICATION AND OPERATION

A. Prior to Fabrication: Verify actual opening dimensions by accurate site measurements. Adjust dimensions for proper fit at openings. Cooperate with other trades for securing brackets to substrates and other finished surfaces. Fabricate window treatment components from non-corrosive, non-staining, non-fading materials which are completely compatible with each other, and which do not require lubrication during normal expected life.

B. Fabricate blind units to completely cover glazing stops by 1" on top, bottom, and sides.

C. Space supporting ladders to comply with manufacturer's standards, unless otherwise indicated.

D. Space slats to provide overlap for light exclusion when in fully closed position.

E. Equip horizontal blind units, unless otherwise indicated for the following operation:

1. Full-tilting operation with slats rotating approximately 180 degrees. Place tilt operating controls on hinged side of doors, unless otherwise indicated.
2. Provide restraints to hold wand and control cords parallel to face of blind units when not in use.
3. Provide Manufacturers' standard hardware to secure bottom rail to doors.

2.4 CUBICLE CURTAINS

A. Lab cubicle curtains in Blewett are as follows:

1. Manufacture: Imperial or approved equal.
2. Maharan: 1FC-50 with side carriers.
3. Pattern/Series: Secco 501508, Atelier.
4. Contents: 100% Trevira® CS Polyester.
5. Width: 72".
6. Repeat: 5 ½" V, 10 ¾" H
7. Lightfastness: Exceeds 60 hours.
8. Carriers are to be made of a one-piece molded nylon slide with a chrome plated steel hook.

9. Finish: satin anodized aluminum with curtain color to be chosen by architect from provided samples.
10. Tracks are to be custom fabricated to shape and size indicated on the plan and they are to be one continuous piece.
11. Provide end caps.
12. Install per industry standards by experienced installer.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. General: Install window treatment units in manner indicated to comply with manufacturer's instructions. Position units level, plumb, secure, at proper height and location relative to adjoining glazing and other related work. Securely anchor units with proper clips, brackets, anchorages, suited to type of mounting indicated.

B. Provide adequate clearance between door hardware and blinds to permit unencumbered operation of door hardware.

C. Protect installed units to ensure their being in operating condition, without damage, blemishes, or indication of use at completion of project. Repair or replace damaged units as directed by the Contracting Officer.

D. Install cubicle curtain with mounting through suspended ceiling to furring above. Wire continuous metal furring over track to structure above.

END OF SECTION 12500

SECTION 14240

HYDRAULIC ELEVATOR

1. GENERAL:

1.1 REFERENCES: Drawings and general provisions of Contract, including General Conditions and Division 1 specifications, apply to work in this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. 110 volt branch circuit to the terminals of the elevator controller for car light supply and 110 volt light and outlet in the elevator pit, complete with switch adjacent to the pit ladder as shown on Elevator Drawings.

B. Any cutting, patching or painting of walls and grouting under thresh-holds and hoistway frames.

C. Adequate supports for guide rail brackets.

D. Sill support angles.

E. Electrical current during erection and testing of equipment. 3 phase fused disconnect, & 110 volt fused disconnect

F. Necessary recesses to accommodate doors, sills, (min. 2-1/2" deep) and signal equipment such as indicators, push buttons, hall lanterns, etc.

G. Pit access ladder.

H. General Contractor to receive, handle and store in the building approximately ten (10) tons of elevator materials.

I. Smoke sensors in each elevator lobby and elevator machine room complete with necessary wiring to elevator controller. A shunt trip circuit breaker with heat detectors will also be provided as required.

1.3 REGULATORY AGENCIES: Perform all work in accordance with the National Electrical Code, American Standard Safety Code and such state and local codes as may be applicable.

1.4 SUBMITTALS: Shop Drawings-

A. Submit six (6) blue print copies of elevator layout drawings to the Architect for approval.

B. Upon completion submit to Owner, warrantee operating manual and maintenance information.

1.5 GUARANTEE:

A. Elevator Contractor shall guarantee that materials and workmanship of apparatus installed by him under these Specifications shall be first class in every respect; and that he will make good any defects not due to ordinary wear and tear or improper use which may develop within one (1) year from date of completion and installation.

B. In addition to the other requirements, inspection, tests and remedies herein provided upon completion of elevator installation and before final approval and final payment, Elevator Contractor shall make, in speed test with full maximum load on elevator to determine whether elevator equipment as installed meets the speed, capacity and all other requirements of the Specifications.

C. In event equipment does not meet all requirements of Specifications, Elevator Contractor shall promptly remove from the premises all work condemned by Architect as failing to conform to the contract and shall bear all expense of making good all work of other Contractors destroyed or damaged by such removal or replacement. If Elevator Contractor does not remedy such condemned work within a reasonable time, fixed by written notice from Architect, General Contractor may correct such condemned work at expense of Elevator Contractor and withhold such cost from final payment under contract price. In the event the remainder due under Contract price is insufficient to cover such a cost, Elevator Contractor shall, immediately upon request, reimburse General Contractor in full.

1.6 PERMITS, TAXES AND LICENSES: All permits, inspection fees and licenses necessary for the execution of the work shall be secured and paid for by the Elevator Contractor.

1.7 TEMPORARY USE: The General Contractor, Sub-contractors, Owner or others will not be permitted use of the elevators during construction except under a written agreement as stipulated by the Elevator Contractor.

2. PRODUCTS:

2.1 ACCEPTABLE MANUFACTURES:

A. Except as otherwise specified herein, or specifically approved by Architect, the Elevator Contractor shall be regularly engaged in installation of elevators of type specified herein, and shall be able to demonstrate at least three (3) installations of this type made by him within the State of Maine which have provided satisfactory operation for a period of one (1) year prior to the date of receipt of General Bids, for this project.

B. Demonstrate that he has provided satisfactory maintenance service for elevators of type specified and that he has maintained a complete maintenance organization comprised of regularly employed inspectors and mechanics within the State of ME for a period of at least one (1) year prior to the date of receipt of General Bids.

C. Provide 1 year maintenance warrantee for insuring problem free operation of elevator, and make available complete ongoing maintenance service package.

D. Elevator shall be equal to Canton Elevator Company, or approved equal. Elevator shall meet latest ANSI handicapped requirements and New Hampshire State Elevator Code.

E. Delivery of elevator systems shall be guaranteed by Manufacturer to be on site sixteen (16) weeks after receipt of approved Shop Drawings. Shop Drawings shall be submitted to the General Contractor for review by the Architect within ten (10) days of Sub-Contractors award.

2.2 MATERIALS AND FABRICATIONS:

A. Description of equipment –
Quantity – 2 elevators front and rear

Capacity:	#1-2500 lbs.; #2-4500
Speed:	100 fpm
Operation:	Simplex sellective collective –confirm with owner
Travel:	Approximately (42'-8") as shown on Drawings
Power supply:	208 v 3 phase, 60 cycle.
Machine Location:	As shown on Drawings (remote)
Stops & Openings:	4 stops –front and rear as shown on drawings
Car Enclosure:	High pressure laminate interior panels, overhead fluorescent lighting above egg crate suspended ceiling, stainless steel returns, and stainless steel car doors. Handrail on side. floor finish by others.
	One (1) set Protection pads and hooks per car
	Include: ADA compliant telephone Fan Emergency Lighting Proximity detectors, door protection
Hoistway Door Frames:	Hollow metal U.L. "B: labeled door, square frame
Door Size & Type:	#1 -3'-6" W x 7'-0"H; #2- 4'-0" wby 7'-0" H (clear opening) finish to be baked enamel; color to be selected from standard selection charts
Door Operation:	D.C. Power Operation
Signals:	Illuminated halo buttons, (Braille) alarm bell, in car location. Hall position indicator at main floor level. In – Car Direction Lantern
Special Features:	Special handicap provisions

	Door Hold Key Service Independent Operation Key Switch Card reader provision
Motor HP:	3 Phase Power 40 HP Max
Starter	Solid state soft start

B. Jack unit:

1. The jack unit shall be designed and constructed in accordance with the applicable requirements of the American Standard Safety Code for Elevators A-17. It shall be of sufficient size to lift the gross load the height specified. It shall be factory tested to insure adequate strength and freedom for leakage. No brittle material, such as gray cast iron, shall be used in the jack construction.

2. The jack unit shall consist of the following parts: a plunger of heavy polished steel tubing accurately turned; a stop ring shall be electrically welded to the plunger to positively prevent plunger leaking its casing made of steel tubing and provided with a pipe connection and air bleeder; Brackets shall be welded to jack casing and supporting the elevator on pit channels.

3. A PVC cylinder protection system shall be installed. Union Guard to fill void no exceptions.

4. A standard wellhole with steel pipe casing to retain the hole shall be provided. All drilling spoils are to be removed by the general contractor. Water for drilling, if required, will be provided by others also. Should obstructions such as rock, boulders, debris, water, quicksand or any other condition other than normal soil or clay be encountered, additional time to drill the hole will be treated as a change order. Work cease until a change order is issued.

C. Car:

1. Platform and Sling: The platform and sling have a fabricated frame of formed and structural steel shapes, gusseted and rigidly welded. Flooring shall be wood top floor laid over wood sub-floor. Finished flooring shall be provided, by others, on top of the car platform.

2. The sling shall consist of heavy steel channel stiles properly affixed to a steel cross head and bolster, with adequate bracing members, to remove all strain from the car enclosure.

3. Steel bumper plates shall be affixed to bottom of bolster channels; and a platen plate with clamps and car screws shall be furnished for fastening sling to plunger.

D. Car doors: The car entrance shall be provided with horizontal sliding doors. Panel rigidity to be obtained by suitable steel reinforcements. Doors shall be hung on sheave hangers with

polyurethane tires and sheaves not less than 2-1/2" diameter running on a polished steel track, and guided at the bottom by non-metallic shoes sliding in a smooth threshold groove.

E. Alarm bell: An emergency alarm bell shall be located in conformance with ANSI A-17 Code requirements, and connected to a plainly marked push button in the car. Alarm bell shall be connected to the emergency lighting power pack.

F. Guide and Guide Shoes: Guides for the elevator car shall be planed steel elevator guide rails, properly fastened to the building structure with steel brackets. The car stile shall be fitted at top and bottom with sliding guide shoes.

G. Power Unit:

1. (Oil pumping and control mechanism) shall be compactly and neatly designed with all of the components listed below combined in a self-contained unit; structural steel outer base with tank supports; floating inner base for mounting motor pump assembly; over head oil reservoir with tank cover and controller compartment with cover; metal drip pan; oil-hydraulic pump; electric motor; and oil control unit with the following components built into a single housing: a high pressure relief valve, a check valve, an automatic unloading up start valve, a lowering and leveling valve, and a magnetic controller, or a self contained submersible of manufactures standard type.

2. The pump shall be especially designed and manufactured for oil-hydraulic elevator service. It shall be of positive displacement screw type, inherently designed for steady discharge with minimum pulsations to give smooth and quiet operation. Output of pump shall not vary more than ten percent (10%) between no load and full load on elevator car.

3. Motor shall be especially designed for oil-hydraulic elevator service, of standard manufacturer and of duty rating to comply with herein specified speeds and loads.

4. Oil control unit shall consist of the following components, all built into a single housing. Welded manifolds with separate valves to accomplish each function will not be acceptable under this Specification. All adjustments shall be accessible and shall be made without removing the assembly from the oil lines:

a. Relief valve shall be externally adjustable and shall be capable of bypassing the total oil flow without increasing back pressure more than ten percent (10%) above that required to barely open the valve.

b. Up start and stop valve shall be externally adjustable, and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, insuring smooth up starts and up stops.

c. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.

d. Lowering valve and leveling valve shall be externally adjustable for drop-away speed, lowering speed, leveling speed and stopping speed to insure smooth "Down" starts

and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling when slow down is initiated.

5. Electric controller shall be of the full magnetic type or solid-state integrated circuitry. Silver to silver contacts shall be utilized on all relays and contractors. Thermal overload relays to be provided to protect the motor. All component switches to be mounted in a steel panel designed for wall to floor mounting. Shall have built in diagnostics, no proprietary tools required to service unit.

H. Mainline Strainer: A mainline strainer of the self-cleaning type, equipped with a 40-mesh element shall be furnished and installed in the oil line.

I. Failure Protection: The electrical control circuit shall be designed so that if a malfunction should occur, due to motor starter failure, oil becoming low in the system, or the car failing to reach a landing in the up direction within a predetermined time, the elevator car will automatically descend to the lowest terminal landing. If power operated doors are used, the doors will automatically open when the car reaches the landing to allow passengers to depart. The doors will then automatically close and all control buttons, except the "door open" button in the car station, shall be made inoperative.

J. Sound Isolating Coupling: Install a minimum of two in the oil line in the machine room between pump and jack.

K. Oil-Hydraulic Silencer (muffler device): Install in oil line near power unit. It shall contain pulsation-absorbing material inserted in a blowout-proof housing arranged for inspecting interior parts without removing unit from oil line. Rubber hose without blowout-proof features will not be acceptable.

L. Vibration Pads: Mount under the power unit assembly to isolate the unit from the building structure.

M. Automatic Terminal Limits: Place electric limit switches in the hatchway near the terminal landing; designed to cut off the electric current and stop the car should it run beyond either terminal landing.

N. Automatic Self-leveling: Provide elevator with a self-leveling feature that will automatically bring the car to the floor landings. This self-leveling shall, within its zone, be entirely automatic and independent of the operating device, and shall correct for over travel or under travel. The car shall also be maintained approximately level with the landing regardless of the load.

O. Buffers: Furnish and install substantial buffers under the car in the elevator pit. They shall be mounted on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor and substantial extensions will be provided, if required. Buffers shall comply with ANSI A-17.1 Code requirements.

P. Car Top Inspection Station: A car top inspection station with an "emergency stop" switch and with constant pressure "up-down" direction buttons shall make the normal operating devices inoperative and give the inspector complete control of the elevator.

Q. Door Operation: Furnish and install a direct current motor driven heavy-duty operator designed to operate the car and hoistway doors simultaneously. Door movements shall be electrically cushioned at both limits of travel and door-operating mechanism shall be arranged for manual operation in event of power failure. The leading edge of the car door shall be provided with a retractable reversal edge arranged to automatically return car and hoistway doors to the open position in the event the doors are obstructed during closing cycle. Doors will then resume closing cycle.

Doors shall automatically open as the car arrives at the landing and shall automatically close after an adjustable time interval or when the car is dispatched to another landing. Direct drive geared operators, A.C. controlled units with oil checks, or other deviations for the above are not acceptable.

R. Interlock: Equip each hoistway entrance with an approved type interlock tested as required by Code. The interlock shall be designed to prevent operation of the car away from the landing until the doors are locked in the closed position as defined by Code and shall prevent opening the doors at any landing from the corridor side unless the car is at rest at the landing or is in the leveling zone and stopping at the landing. Interlocks shall bear Underwriter's Laboratories "B" label of approval.

S. Hoistway Door Unlocking Device: Provide hoistway door unlocking devices as specified by the ANSI A-17.1 Code to permit authorized persons to gain access to hoistway when elevator car is away from the landing.

T. Door Hangers and Tracks: For each hoistway sliding door, furnish and install sheave type two point suspension hangers and tracks complete. Sheaves shall be 2-1/2" in diameter and have polyurethane tires with ball bearings properly sealed to retain grease. Hangers shall be provided with an adjustable slide to take the up-thrust of the doors. Tracks are to be drawn steel shapes, smooth surface and shaped to conform to the hanger sleeves.

U. Hoistway Entrances: Hoistway entrances of the hollow metal, horizontal sliding type shall be furnished and installed complete at each of the hoistway openings. Note that entrances must be at least minimum legal width for wheelchair use, meeting ANSI A-17.1.

1. Entrances shall be manufacturer's standard design and shall bear Underwriter's Laboratories "B" labels. They shall consist of frames, sills, doors, hangers, hanger supports, hanger covers, fascia plates, and all necessary hardware. Finish to be baked on prime enamel for finish painting in the field by others.

2. The entire front wall of the hoistway is to be left open or a rough opening provided which is 12" greater in width and 6" greater in height than the finished opening, until after entrances are installed. After guide rails are set and lined, the entrance frames shall be installed in perfect alignment with the guide rails. Finish walls will then be completed by others.

V. ADA telephone shall be furnished with wiring from elevator cab to the machine room and telephone box. Wiring to be coordinated with Electrical Contractor and tied into outside phone system.

W. Operation (Selective Collective Automatic Push-button): Control of the elevator car shall be automatic in operation by means of a push-button in the car marked for each of the landing levels served and an "up-down" button at each intermediate landing with a call button at each terminal landing, wherein all stops registered by the momentary pressure of landing or car buttons shall be maintained until the car answers the call. An emergency stop switch shall be provided in the car push-button station which, when in the off position, will render the elevator inoperative, and which will enable attendant or passenger to stop the car at any point during its travel. Opening of this switch shall not cancel registered calls, and when the switch is closed the car will continue to answer calls that have been registered. Each landing station shall contain an illuminated push-button which shall "light-up" when pressed to indicate that a call has been registered to bring the car to that particular landing. A time delay non-interference feature shall be incorporated in the control mechanism to allow simple time for opening and closing car and hoistway doors before it is again placed in motion.

X. Special Emergency Service:

1. Special Emergency Service Operation shall be provided in compliance with the latest revision of the ASME/ANSI A17.1 or CAN3-B44 Code.

2. Special Emergency Service Phase I to return the elevator non-stop to a designated floor shall be initiated by an elevator smoke detector system or a keyswitch provided in a lobby fixture.

3. The smoke detector system is to be furnished by others. The elevator contractor shall provide contacts on the elevator controller to receive signals from the smoke detector system.

4. A keyswitch in the car shall be provided for in-car control of each elevator when on Phase II of Special Emergency Service. Fire service to comply with the latest requirement by the State of Maine.

5. If an elevator is on independent service when the elevator is recalled on Phase I operation, a buzzer shall sound in the car and a message indicator will be activated.

END OF SECTION

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SECTION 211100 – FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following fire-suppression piping inside the building:

1. Automatic or manual wet-type, Class I standpipe systems.
2. Wet-pipe sprinkler systems.

B. Related Sections include the following:

1. Division 2 Section "Water Distribution" for piping outside the building.

1.3 DEFINITIONS

A. Underground Service-Entrance Piping: Underground service piping entering the building.

1.4 SYSTEM DESCRIPTIONS

A. Combined Standpipe and Sprinkler System: Fire-suppression system with both standpipe and sprinkler systems. Sprinkler system is supplied from standpipe system.

B. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

C. Manual Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has small water supply to maintain water in standpipes. Piping is wet, but water must be pumped into standpipes to satisfy demand.

D. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.

B. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.

1. Unless otherwise indicated, the following is maximum residual pressure at required flow at each hose-connection outlet:

a. NPS 2-1/2 Hose Connections: 100.0 psig or lower pressure, 65.0 psig minimum, as directed by the authorities having jurisdiction.

C. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction and FM Global.

1. Margin of Safety for Available Water Flow and Pressure: 10 PSI, including losses through water-service piping, valves, and backflow preventers.
2. Maximum velocity in the sprinkler system shall not exceed 20.0 FPS.
3. Sprinkler Occupancy Hazard Classifications:

a. Building Service Areas: Ordinary Hazard, Group 1.
b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
c. General Storage Areas: Ordinary Hazard, Group 1.
d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
e. Office and Public Areas: Light Hazard.
f. Ordinary Hazard, Group 1.
g. Laboratories and Animal Rooms: Ordinary Hazard Group 1.

4. The following is a list of the minimum Density for Automatic-Sprinkler Piping Design. The Insurance Underwriter for this project may require different densities, which must be verified and followed.

a. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 2500-sq. ft..
b. Special Occupancy Hazard: As determined by authorities having jurisdiction.

5. Maximum Protection Area per Sprinkler:

a. Office Spaces: 168 sq. ft.
b. Storage Areas: 130 sq. ft.
c. Mechanical Equipment Rooms: 130 sq. ft.
d. Electrical Equipment Rooms: 130 sq. ft.
e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.

D. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13, and shall also comply with the IBC Building Code/2006 and State Building Code, "Minimum Design Loads for Buildings and Other Structures", "Earthquake Loads."

1.6 SUBMITTALS

A. Product Data: For the following:

1. Piping materials, including sprinkler specialty fittings.
2. Pipe hangers and supports, including seismic restraints.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim, and backflow preventer device.
4. Mechanical pipe and expansion joint fittings.

5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
6. Hose connections, including size, type, and finish.
7. Fire hose cabinets.
8. Pipe and valve identification.
9. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
10. Alarm devices, including flow, supervisory and pressure switches, including electrical data.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Approved Sprinkler and Standpipe Piping Drawings: Working plans, prepared according to NFPA 13 and NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.

D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

E. Welding certificates.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 14, "Installation of Standpipe, Private Hydrant, and Hose Systems."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that attach to or penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with sprinklers and wrench for each type of sprinkler on Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Manufacturers must be ISO certified.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-End, Cement Lined, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.

1. Grooved-Joint Piping and Fitting Systems:

a. Manufacturers:

1) Victaulic Co. of America.

b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD and cement lining.

c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.

d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing with key matching ductile-iron-pipe groove and key matching steel-pipe groove, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

e. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

2.3 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.

1. Malleable-Iron Threaded Fittings: ASME B16.3.
2. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
3. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.

a. Manufacturers:

1) Anvil International, Inc.
2) Victaulic Co. of America.
3) Ward Manufacturing.

B. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Grinnell Corporation
2) Victaulic Co. of America.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

C. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 with factory, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Grinnell Corporation.
2) Victaulic Co. of America.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe O.D. Include ductile-iron

housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.4 DIELECTRIC FITTINGS

A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

B. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

C. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products and Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

D. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psigworking-pressure rating at 225 deg F.

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

E. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psigworking-pressure rating at 225 deg F.

1. Manufacturers:

a. Perfection Corporation.
b. Precision Plumbing Products, Inc.
c. Victaulic Co. of America.

2.5 FLEXIBLE CONNECTORS

A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:

1. NPS 2 and Smaller: Threaded.
2. NPS 2-1/2 and Larger: Flanged.
3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Manufacturers:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Mercer Rubber Co.
4. Metraflex, Inc.
5. Proco Products, Inc.
6. Unaflex Inc.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

2.6 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 300-psig working-pressure rating if fittings are components of high-pressure piping system.

B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Manufacturers:

a. Victaulic Co. of America.
b. AGF Manufacturing Company.
c. Sure Test.

C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Manufacturers:

a. AGF Manufacturing Co.
b. Sure Test.
c. Victaulic.

E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.

1. Manufacturers:

a. CECA, LLC.
b. Merit.

2.7 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Valves shall have 300-psig pressure rating if valves are components of high-pressure piping system.

B. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
3. Manufacturers:

a. NIBCO.
b. Victaulic Co. of America.

C. Butterfly Valves: UL 1091.

1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

1) Central Sprinkler Corp.
2) Mueller Company.
3) Victaulic Co. of America.

D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers:

a. Fairbanks
b. Jenkins
c. Kennedy Valve, Div of ITT Grinnell Valve Co., Ind.
d. Stockham
e. Viking Corp.

E. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) Fairbanks
2) Jenkins
3) Kennedy Valve, Div of ITT Grinnell Valve Co., Ind.
4) Stockham
5) Viking Corp.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Manufacturers:

1) Fairbanks
2) Jenkins
3) Kennedy Valve, Div of ITT Grinnell Valve Co., Ind.
4) Stockham
5) Viking Corp.

F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, 2-circuit, supervisory switch.
2. NPS 2 and Smaller: Ball valve with bronze body and threaded ends.

a. Manufacturers:

1) Milwaukee Valve Company.
2) Victaulic Co. of America.

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; LVG type or with flanged or grooved ends.

a. Manufacturers:

1) Central Sprinkler Corp.
2) Milwaukee Valve Company.
3) Victaulic Co. of America.

2.8 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.9 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating. Control valves shall have 300-psig pressure rating if valves are components of high-pressure piping system.

1. Manufacturers:

a. Reliable Automatic Sprinkler Co., Inc.
b. Victaulic Co. of America.
c. Viking Corp.

2. Wet Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

B. Dry-Pipe Valves: UL 260, differential type; with bronze seal with O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

1. Air-Pressure Maintenance Device: UL 260, automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig maximum inlet pressure.

a. Manufactures:

1) Central Sprinkler Corp.
2) General Air Products, Inc.
3) Reliable Automatic Sprinkler Co., Inc.
4) Viking Corp.
5) Victaulic.

2. Riser-Mounted Air Compressor: UL 753, fractional horsepower, 120-V AC, 60 hZ, single phase.

a. Manufacturers:

1) Reliable Automatic Sprinkler Co., Inc.
2) Viking Corp.
3) General Air Products, Inc.

C. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers:

a. AFAC Inc.
b. Grinnell Fire Protection.

2.10 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 300-psig pressure rating if sprinklers are components of high-pressure piping system.

B. Manufacturers:

1. Automatic Sprinkler Corp of America
2. Guardian Automatic Sprinkler Co., Inc.
3. Reliable Automatic Sprinkler Co., Inc.
4. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Pendent sprinklers.
3. Pendent, dry-type sprinklers.
4. Quick-response sprinklers.
5. Upright sprinklers.
6. Sidewall, dry-type sprinklers.

F. Sprinkler Finishes: White painted in finished areas, exposed to view, rough bronze finish for heads in unfinished spaces and not exposed to view.

G. Special Coatings: Wax-coated where installed exposed to acids, chemicals, or other corrosive fumes.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.11 HOSE CONNECTIONS

A. Manufacturers:

1. Guardian Fire Equipment, Inc.
2. United Brass
3. Viking Corp.

B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle pattern design; female NPS inlet and male hose outlet; NPS 2-1/2" and lugged cap, gasket, and chain. Include NPS 2-1/2" as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type.
2. Finish: Rough chrome-plated.

C. Valve Cabinet Description:

1. Cabinet Material: Enameled steel sheet.
2. Type: Fire hose valve.
3. Mounting: Flush recessed.
4. Door prime-coated steel with double strength full panel glass and pull handle.
5. Cabinet Size: 18" x 18" x 8" for single valve with NPS 2-1/2".

2.12 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers:

1. Guardian Fire Equipment, Inc.
2. United Brass
3. Viking Corp.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; Chrome, flush wall type, with wall escutcheon. Connection size shall be 4 inch Storz. Wall escutcheon shall have words similar to "AUTO SPKR & STANDPIPE -FIRE DEPARTMENT CONNECTION" or "STANDPIPE – FIRE DEPARTMENT CONNECTION" or " AUTO SPKR – FIRE DEPARTMENT CONNECTION" or " Manual Standpipe – Fire Department Connection".

1. Type: Flush, with round escutcheon plate.
2. Finish: Polished chrome-plated.

2.13 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.

1. Manufacturers:

a. Reliable Automatic Sprinkler Co., Inc.
b. Viking Corp.

C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Manufacturers:

a. Potter Electric Signal Company.

D. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.

1. Manufacturers:

a. Potter Electric Signal Company.

E. Low Pressure Supervisory Switch: Electrical-supervision-type, waterflow switch with retard feature. Adjustable between 10 psi – 175 psi. Pressure switch shall operate with two sets of SPDT contacts.

1. Manufacturers:

a. Potter Electric Signal Company.

F. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers:

a. Potter Electric Signal Company.

G. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

1. Manufacturers:

a. Potter Electric Signal Company.

2.14 PRESSURE GAGES

A. Manufacturers:

1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Dresser Equipment Group; Instrument Div.

B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 EARTHWORK

A. Refer to Division 2 for excavating, trenching, and backfilling.

3.3 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

E. Underground Service-Entrance Piping: Ductile-iron, cement lined, class 52, mechanical-joint pipe and fittings and restrained joints. Include corrosion-protective encasement.

3.5 FIRE PROTECTION SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Fire Protection System, 175-psig Maximum Working Pressure:

1. NPS 2 and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
2. NPS 2-1/2 to NPS 10: Grooved-end, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and roll grooved joints. Wall thickness per NFPA requirements.

B. Standard-Pressure, Dry-Pipe System, 175 psig, Maximum Working Pressure:

1. NPS 1-1/2 and Smaller: threaded-end, galvanized, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints. All materials to be galvanized.
2. NPS 2: Grooved-end, galvanized, standard-weight steel pipe; grooved-end fittings; grooved-end pipe couplings; and grooved joints. All materials to be galvanized.

3.6 STANDPIPE SYSTEM PIPING APPLICATIONS

A. Standard Pressure, Wet Type Standpipe System, 175-psig, Maximum Working Pressure;

1. NPS 4: Threaded end, standard weight steel pipe; cast or malleable iron threaded fittings; and threaded joints.
2. NPS 4: Grooved end, black standard weight steel pipe with roll grooved end fittings; grooved end pipe couplings; and grooved joints.
3. NPS 4: Grooved end, black Schedule 30 steel pipe; grooved end fittings; grooved end pipe couplings; and grooved joints.
4. NPS 6: Grooved end, black standard weight steel pipe with roll grooved end fittings; grooved end fittings; grooved end pipe couplings; and grooved joints.
5. NPS 6: Grooved end, black Schedule 30 steel pipe; grooved end fittings; grooved end pipe couplings; and grooved joints.

3.7 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13 and NFPA 14.

a. Shutoff Duty: Use ball, butterfly, or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13 and NFPA 14.

a. Shutoff Duty: Use ball, butterfly, or gate valves.
b. Throttling Duty: Use ball or globe valves.

3.8 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
3. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
2. NPS 2-1/2 to NPS 4: Use dielectric flanges.
3. NPS 5 and Larger: Use dielectric flange insulation kits.

3.9 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.

B. Install shutoff valve, pressure switch, flow switch, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 22 Section "Plumbing Specialties" for backflow preventers.

3.10 PIPING INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Install underground ductile-iron, cement lined service-entrance piping according to NFPA 24 and with restrained joints.

D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install drain valves on standpipes.

K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

L. Install alarm devices in piping systems.

M. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. Install standpipe system piping according to NFPA 14.
2. Install sprinkler system piping according to NFPA 13.

N. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.

O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal

seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

P. Fill wet-standpipe system piping with water.

Q. Fill wet-pipe sprinkler system piping with water.

3.11 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections and fire pump test headers and elsewhere required. Install permanent identification signs indicating portion of system controlled by each valve.

C. Valves for Wall-Type Fire Hydrants: Install nonrising-stem gate valve in water-supply pipe.

D. Install backflow preventers in potable-water supply sources.

E. Specialty Valves:

1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.12 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used.

B. Temperature ratings of heads in machine rooms, kitchens, storage rooms, unventilated spaces, mechanical rooms, electrical rooms, unventilated attic spaces, ceiling spaces, crawl spaces and tunnels and in any areas where ceiling temperature is expected to exceed 100°F shall be intermediate temperature classification. Heads near high temperature equipment and piping shall have temperature rating as required by NFPA 13. Temperature classifications for other heads shall be ordinary temperature classification, unless otherwise noted.

C. For exposed pipe installations, heads shall be brass: Reliable Model GFR (Quick-Response).

D. For installation in finished ceilings, concealed heads shall be factory painted white, adjustable: Reliable Model G4A (Quick-Response).

E. For installation in finished ceilings, pendent heads shall be factory painted white with matching escutcheon: Reliable Model GFR (Quick-Response).

F. Horizontal sidewall heads in finished areas shall be bright chrome plated, with matching escutcheon: Reliable Model GFR (Quick-Response).

G. Vertical pendent sidewall heads in finished areas shall be factory painted white with matching escutcheon: Reliable Model F1FR (Quick-Response, for light hazard only).

H. Dry pendent heads shall be bright chrome-plated, with recessed escutcheon; Reliable Model F3QR (Quick-Response, for light and ordinary hazard). In all cold rooms such as coolers, provide EPDM, 50 Durometer-Type rubber boot to prevent condensation formation: Tyco Model DSB-1.

I. Dry horizontal sidewall heads, for installation at 4"-12" below ceilings and obstructions, shall be factory painted white with matching escutcheon: Reliable Model F3QR (Quick-Response, for light and ordinary hazards).

J. In areas where heads are subject to physical damage, provide sprinkler guard assembly over head: Reliable Model C-1 or Reliable Model C-2 for dry heads. This shall include but not be limited to:

1. Heads in elevator shafts
2. Heads under lower rakes of stairways
3. Heads in electrical rooms
4. Heads in machine rooms
5. Heads in boiler rooms and other mechanical rooms
6. Heads installed 7'-0" or less above finished floor
7. Heads located in cold rooms

K. When pendent sprinkler heads are installed adjacent to vertical obstructions such as surface-mounted light fixtures, provide matching two-piece extension escutcheons: Reliable Model HB with chrome finish.

L. Furnish minimum six spares of each style and type of head; furnish sprinkler wrench and storage cabinets. Furnish additional quantities if required by Code. Storage cabinet shall be steel with red finish: Potter-Roemer #6162.

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers, as indicated.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Pendent, dry sprinklers, Sidewall, dry sprinklers as indicated.
5. Special Applications: Quick-response sprinklers where applicable by NFPA13 and IBC.
6. Sprinkler Finishes:

    a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
    b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
    c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
    d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
    e. Residential Sprinklers: Dull chrome.

3.13 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center (in both directions) of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.14 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes, unless otherwise indicated.

B. Install NPS 2-1/2 hose connections with quick- disconnect NPS 2-1/2, unless otherwise indicated.

C. Install wall-mounting-type hose connections in flush recessed cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose.

3.15 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type Storz, fire department connections in vertical wall.

B. Install ball drip valve at each check valve for fire department connection.

3.16 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 22 Section "Plumbing Specialties" for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Electrical Connections: Power wiring is specified in Division 16.

G. Connect alarm devices to fire alarm.

H. Ground equipment according to Division 26 Section "Grounding and Bonding."

I. Connect wiring according to Division 26 Section "Conductors and Cables."

J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.17 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14 and in Division 23 Section "Mechanical Identification."

3.18 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Energize circuits to electrical equipment and devices.
4. Start and run air compressors.
5. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
6. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
7. Coordinate with fire alarm tests. Operate as required.
8. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.19 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.20 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 1 Sections "Conditions of the Contract" and "Supplementary Conditions".

END OF SECTION 211100

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SECTION 220000

PLUMBING TRADE WORK

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this section to establish the scope of work for plumbing systems. Specifications governing the plumbing work are included under the PLUMBING sections, under the BASIC MATERIALS sections, and under other sections detailing general requirements. Refer also to:

1. GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS
2. Section 230500, General Requirements for Mechanical Work
3. Section 230501, Basic Materials & Methods - Mechanical
4. Section 15160, Basic Materials - Seismic Restraint & Vibration Isolation for Mechanical
5. Section 230719, Basic Materials - Mechanical Insulation
6. Section 230593, Basic Materials - Testing, Adjusting, and Balancing (Separately Contracted By Owner)
7. Section 224000, Plumbing Equipment & Fixtures

B. SECTION 230501 has a detailed description on understanding how the general BASIC MATERIALS Sections are to be used in conjunction with the project-specific TRADE sections. Refer to SECTION 230501, paragraph on INTENT.

C. In this Section, above-grade piping shall mean piping that is not buried and below-grade piping shall mean buried piping.

1.2 SHOP DRAWING SUBMITTALS

A. Submit for review shop drawings for each item of material, equipment, and system component furnished or installed as part of the work of this Section. Shop drawing requirements are specified under SECTION 230500, GENERAL REQUIREMENTS FOR MECHANICAL WORK and under DIVISION 1.

B. Shop drawings shall identify system and intended use of pipe, valve, etc.

C. Shop drawings shall include piping diagrams and wiring diagrams.

D. Shop drawings shall include motor efficiency data for three-phase motors 1 HP and larger.

E. Submit piping system test results for review.

F. Submit startup reports, in triplicate, to Architect for review and record. Refer to paragraph.

1.3 COORDINATION DRAWINGS

A. Before materials are purchased or work is begun, prepare Coordination Drawings showing size and location of mechanical pipes, ducts, equipment and appurtenances, relative to work of other trades.

B. Submit for review coordination CAD drawings with accompanying electronic files. Hard copy of drawings shall be signed by following trades: sheet metal, plumbing, fire protection, electrical, and other HVAC trades. Electronic (CAD) drawing files shall be produced with each trade represented by separate layers. All drawings shall be done in Autocad format.

C. Preliminary coordination drawings shall be prepared as follows:

1. First: Sheet metal trade shall prepare coordination drawings, minimum 3/8□=1□ scale, to be used as composite construction floor plans for coordination of trades. Plans shall show floor and ductwork layouts in detail, including ceiling heights, duct heights and sizes (including insulation), registers and diffusers, and light fixtures.
2. Second: As part of work of SECTION 211100, fire protection trade shall draw fire protection piping, etc., on coordination drawings prepared by sheet metal trade.
3. Third: As part of DIVISION 26, ELECTRICAL WORK, electrical trade shall draw electrical distribution conduits, wires, panels, and other electrical work which must be coordinated with other trades; on coordination drawings which have been prepared by fire protection trade.
4. Fourth: As part of work of Division 22, plumbing trade shall draw waste piping, vent piping, water piping, risers and other plumbing work which must be coordinated with other trades; on coordination drawings which have been prepared by electrical trade.
5. Fifth: As part of work of Division 23, HVAC trades shall draw HVAC piping work which must be coordinated with other trades; on coordination drawings which have been prepared by plumbing trade.
6. Each trade shall use a different color code.

D. Coordination Meeting and Drawing Revisions

1. Sixth: Contractor shall hold a coordination meeting with sheet metal, HVAC, fire protection, electrical and plumbing trades and shall resolve conflicts between trades. Coordination drawings are to assist in identifying trade conflicts.
2. Seventh: Sheet metal trade shall revise coordination drawings to reflect revisions to the various trade work (including sheet metal, HVAC, fire protection, electrical and plumbing trades), as determined by coordination meeting.
3. Eighth: Sheet metal, HVAC, fire protection, electrical and plumbing trades shall sign the revised coordination drawings as indication of their acceptance of the construction layout shown thereon.

E. Sheet metal trade shall submit the revised coordination drawings to Architect for review.

F. Coordination Drawings are for Contractor's and Engineer's use during construction and shall not be construed as replacing shop, "as-built" or record drawings required elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.1 PIPING

PIPING (REFER TO DIVISON 22)			
Application	**Pipe Size**	**Pipe Type**	**Fittings/Joints**
Domestic Cold Water non-buried	1/2 " to 2"	Copper type L	Solder
			"Pro-Press System"
	2-1/2" to 6"	Copper type L	Grooved joint
Domestic Hot Water and Recirculated	1/2 " to 2"	Copper type L	Solder
			"Pro-Press System"
	2-1/2" to 6"	Copper type L	Grooved joint
Laboratory (Non-Potable) Cold, Hot and Recirculated	1/2 " to 2"	Copper type L	Solder
			"Pro-Press System"
	2-1/2" to 6"	Copper type L	Grooved joint
Non-Potable Cold Water	1/2 " to 2"	Copper type L	Solder
			"Pro-Press System"
	2-1/2" to 6"	Copper type L	Grooved joint
Tempered water (TW) serving emergency fixtures	3/4" to 2"	Copper type L	Solder
			"Pro-Press System"
RO/DI Water Supply & Return	All	AP Polypropylene	Socket Fusion
Sanitary, waste non-buried	All	ABS DWV, Schedule 40	Solvent cemented
		Plastic PVC, Schedule 40	
Sanitary, waste buried	All	ABS DWV, Schedule 40	Solvent cemented
		Plastic PVC, Schedule 40	
Storm water non-buried	All	No-hub cast iron	High torque clamp
Storm water buried	All	No-hub cast iron	High torque clamp

PIPING (REFER TO DIVISON 22)			
Application	**Pipe Size**	**Pipe Type**	**Fittings/Joints**
		Plastic PVC, Schedule 40	Solvent cemented
Condensate Drainage	All	Plastic PVC, Schedule 40	Solvent cemented
Vent non-buried	All	No-hub cast iron	Standard torque clamp
NPCW Atmospheric Storage Tank Vent	All	Copper type L	DWV
Vent buried	All	Cast iron, hub & spigot	Push-on neoprene gasket
		No-hub cast iron	Standard torque clamp
Lab waste and vent non-buried	1-1/2" to 4"	Plastic polypropylene	Mechanical joint
	5" to 6"	Plastic polypropylene	Mechanical joint
Lab waste and vent buried	All	Plastic polypropylene	Fusion welded
Sump pump discharge, above-grade	All	Copper type L	DWV
Gas piping non-buried	All	Black steel, Schedule 40	Malleable iron screwed
			Welded
Gas piping, exterior (site)	All	Black steel, Schedule 40, Mil-wrapped	Malleable iron screwed
Compressed Air, Lab-Air and Lab Vacuum	All	Copper type L	Silver solder prior to dryers. Soldered.
Trap primer, buried	All	Copper Buried, Type K	JOINTS NOT ALLOWED
Trap primer, in concrete	All	Plastic PVC, pressure service, Schedule 40	Solvent cemented
Trap primer, exposed	All	Copper Type L	Soldered

2.2 GENERAL SERVICE VALVES

GENERAL SERVICE VALVES (REFER TO DIVISION 22)		
Service	**Size**	**Valve Type**
Domestic and Laboratory cold, hot and recirculated	3" & smaller	Ball valve, two-piece body
	4" & Larger	Butterfly valve, general service
DI Water	All	Polypropylene ball valve
Compressed air	All	Ball valve, two-piece body
Vacuum	All	Ball valve, two-piece body

A. Whether shown on Drawings or not shown on Drawings, provide valves at following locations:

1. Main service entrance to building.
2. Branches off mains.
3. Divisions of mains.
4. Supply connections to fixtures and other apparatus.
5. As required by Code.

2.3 SPECIAL USE & SPECIAL SERVICE VALVES

A. For valves 3□ and larger located more than 7 feet above floor, provide chain wheel operators with mounting hardware and galvanized steel chain.

B. Drain Valves, Gauge Cocks

1. Ball valves: Two-piece brass, full port, TFE Teflon seat and seal, threaded ends; Jamesbury "Style A", Crane #9302, Crane #9322, or Milwaukee #BA-100H.
2. Drain valve shall have a 3/4" hose thread on outlet, with brass cap and chain.

C. Ball Valve, Balancing

1. Valves ½" through 3" size: bronze body, brass ball, brass readout valves with EPT check valve, EPDM stem O-ring, NPT connections, 300 psig maximum working pressure at 250°F: Bell & Gossett "Circuit Setter Plus", or Armstrong #CBV-I.
2. Valves 4" size: cast iron flanged body with bronze vane, integral check valve, 125 psig working pressure at 250°F: Bell & Gossett #CB-4, or Armstrong #CBV-II.

D. Fuel Gas (Natural Gas) Valves

1. Fuel gas system valves shall be by Jamesbury, Crane, Stockham, Milwaukee or Serchaudco.
2. Valves 2" and smaller: two-piece, full port, carbon steel body, 316 stainless steel ball, TFE Teflon seats, TFE Teflon seals, approved for gas service; Jamesbury #23-22 "Fire-Tite".

3. Valves 3" and larger: full port, double seal, UL and FM approved for gas service, flanged carbon steel body, stainless steel ball, split body design, TFE seats and seals, with lever handle operator; Jamesbury Series 6150, "Fire-Tite".
4. On supply pipes to gas turrets and other equipment, provide iron body cocks with bronze square head plugs: Crane #324.

2.4 FLASHING

A. Furnish flashing for installation under ARCHITECTURAL DIVISIONS; as follows:

1. Flashing for roof drain penetrations through roof and decks shall be 4 lb. lead flashing.
2. Flashing for vent penetrations through roof and decks shall be 3 lb. lead flashing.
3. Flashing for prefabricated vent penetrations through roof and decks shall be 2.5 lb. lead flashing.
4. Vent flashing shall have 16"x16" base, shall be 4" higher than vent piping, and shall have 6" return.
5. Roof drain flashing shall be 24"x24".

B. Provide 7 lb. lead flashing on floor drains in upper floors. Flashing shall extend minimum 6" beyond outside dimension of anchor flange.

2.5 INSULATION

PIPE INSULATION SCHEDULE (Refer also to SECTION 230719)

Piping	Fluid Temp. Range	Pipe Size	Insulation Thickness	Insulation Type
Domestic hot water, recirculating and tempered water. Lab hot water and lab recirculating.	0-150°F	2" & smaller	1"	FG
	0-150°F	2-1/2" & larger	1-1/2"	FG
	151°F +	All sizes	1-1/2"	FG
Domestic cold water. Lab cold water.	Any	1-1/4" & smaller	½"	FG
		1-1/2" & larger	1"	FG
Horizontal Primary and Secondary Storm,	Any	All sizes	1"	FG
Condensation piping	Any	All sizes	½"	FG
Buried copper pipe	Any	All sizes	½"	FF
Handicapped lavatory & sink exposed piping including P-trap	Any	All sizes	Manufact-urer's minimum	HC

PIPE INSULATION SCHEDULE (Refer also to SECTION 230719)				
Piping	**Fluid Temp. Range**	**Pipe Size**	**Insulation Thickness**	**Insulation Type**
Primary and Secondary Roof drain bowls	Any	All sizes	½" maximum	FF
Primary and Secondary Storm, waste & water piping exposed to weather and electrically heat traced	Any	All sizes	1"	FG
Floor drain bodies, traps and horizontal waste piping carrying HVAC condensate and other chilled water discharge	Any	All sizes	½"	FG/FF
Gauge	Any	All sizes	½"	FG/FF
Cold Water Make-up	Any	2" & smaller	½"	FG
		2-1/2" & larger	1"	FG

2.6 ISOLATION AND SEISMIC RESTRAINT SCHEDULE

A. Seismic restraint shall be provided on following piping systems at turns of more than 4 feet and throughout entire run; where piping is supported by hangers longer than 12', as measured from top of pipe to bottom of supporting structure. Restraint type and maximum spacing of restraints shall be as follows:

PIPE SEISMIC RESTRAINT SCHEDULE (Refer to SECTION 15160)				
Piping	**Pipe Size**	**Seismic Restraint Type**	**Maximum Spacing between Seismic Restraints**	
			Transverse	**Longitudinal**
Gas piping	All	SR-C	20'-0"	40'-0"
No-hub piping with standard couplings	1" & larger	SR-C	20'-0"	40'-0"
No-hub piping with ½ G couplings	1" & larger	SR-C	40'-0"	80'-0"
Compressed air piping	1" & larger	SR-C	20'-0"	40'-0"
Lab Air, Lab Vacuum, Other piping in mechanical rooms	1-1/4" & larger	SR-C	40'-0"	80'-0"

PIPE SEISMIC RESTRAINT SCHEDULE (Refer to SECTION 15160)				
Piping	**Pipe Size**	**Seismic Restraint Type**	**Maximum Spacing between Seismic Restraints**	
			Transverse	**Longitudinal**
Other piping in any space	2-1/2" & larger	SR-C	40'-0"	80'-0"

B. Vibration isolation shall be provided on piping within 50 feet of connection to isolated equipment. Isolation type, minimum deflection, and maximum spacing of isolation devices shall be as follows:

PIPE VIBRATION ISOLATION SCHEDULE (Refer also to SECTION 15160)			
Piping	**Vibration Isolation Type**	**Minimum Deflection**	**Maximum Isolation Spacing**
Water piping within 50 feet or 100 diameters of rotating equipment	VI-SEH	1" *	at every hanger

C. Seismic restraint shall be provided on plumbing equipment. Vibration isolation shall be provided on plumbing equipment where indicated. Isolation and restraint device types and minimum deflection shall be as follows:

SUSPENDED EQUIPMENT SEISMIC RESTRAINT & VIBRATION ISOLATION SCHEDULE (Refer also to SECTION 15160)			
Suspended Equipment	**Isolator Type**	**Minimum Static Deflection**	**Seismic Restraint Type**
In-line pumps	SRVI-DD*	0.30"	SRVI-DD*
Wall-mounted non-isolated equipment, if not specified elsewhere	NA	NA	SR-B
Non-isolated equipment suspended from structure, if not specified elsewhere	NA	NA	SR-C
* Combination seismic restraint and isolator.			

BASE-MOUNTED EQUIPMENT SEISMIC RESTRAINT & VIBRATION ISOLATION SCHEDULE (Refer also to *SECTION 15160)*			
Base-Mounted Equipment	**Isolator Type**	**Minimum Static Deflection**	**Seismic Restraint Type**
Circulating pumps	SRVI-SI*	0.30"	SRVI-SI*
Floor-mounted non-isolated equipment, if not specified elsewhere	NA	NA	SR-B
* Combination seismic restraint and isolator.			

D. Roof-mounted piping systems shall be supported by the following various support systems: single post support, bridging systems, strut supports and pipe supports. These systems shall be manufactured from non-corrosive material such as stainless steel, fiberglass reinforced nylon, neoprene and black neoprene. Material must be weatherproof and UV stabilized for long exposure life. Support systems shall be as manufactured by MAPA Products, Naples, Texas or acceptable equivalents.

E. Flow Meters: ABB Water Meters Model C-700 with Scalable Pulse Output.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION - GENERAL

A. The run and arrangement of pipes shall be: approximately as shown on Drawings; as directed during installation; as straight and direct as possible; neatly spaced; forming right angles or parallel lines with building walls and other pipes.

B. Horizontal runs of piping, except where concealed in partitions, shall be installed as high as possible, close to walls. Offsets shall be installed parallel to structural elements or partitions; adjacent to underside of structure.

C. Pitch hose bib water supply piping in unheated areas to low point, to allow complete drainage of piping system in winter.

D. Provide drain valves at low points of piping risers.

E. Plumbing Piping Insulation

1. Insulate cold water, hot water and hot water recirculating piping, including valve bodies, strainers, flanges and other piping accessories.
2. Insulate roof drain bowls and roof drain piping, both horizontal and vertical, from drain bowl to vertical leaders. Insulate other horizontal above-slab storm piping in building.
3. Insulate sanitary and waste drainage piping that is exposed in outside air plenums, when exposed to weather and when shown on Drawings. Install insulation only after heat tape

has been installed on piping; heat tape shall be provided as part of work of DIVISION 16, ELECTRICAL WORK.

4. Insulate exposed waste and water piping below handicapped lavatories including tailpieces, waste arms, traps, supplies, extensions, and stops.
5. Insulate copper condensate piping. Insulate copper piping buried under slabs, e.g., piping to island sinks and trap primer piping.

3.2 INSTALLATION OF DRAINAGE PIPING

A. Pitch drainage piping as follows:

1. Storm, sanitary, waste and condensate drainage piping, 3□ and smaller, shall have minimum pitch of 1/4□ per foot.
2. Storm, sanitary, waste and condensate drainage piping, 4□ and larger, shall have minimum pitch of 1/8□ per foot.
3. Vent piping shall be run to permit free circulation of air and either at uniform pitch or so as to allow drainage back to soil or waste piping without trapping. Fittings shall be installed in direction of airflow.

B. Provide accessible cleanouts:

1. At traps.
2. At every 90° change in direction.
3. Every 50 feet of horizontal run of pipe 4" and smaller.
4. Every 100 feet of horizontal run of pipe 5" and larger.
5. At base of every stack and every leader.
6. At end of every run of mains and of branch piping.
7. Wherever pipe leaves building.
8. As necessary, so that 50-foot snake can be effectively used on any part of system.
9. As shown on Contract Drawings.

C. Cleanouts in piping below floor shall be brought up within easy reach and terminated below an access plate set flush with finished floor. Adjust cleanout heads to proper finish floor elevation while concrete is still green.

D. Where wall cleanouts are not practical, cleanouts in vertical piping shall be located behind access doors or access plates.

E. Traps connected to the sanitary system shall be vented as shown on Contract Drawings and as required by Code. Traps shall NOT be crown-vented.

F. Vent stacks passing through roof shall increase to 4" in size below roof and shall extend minimum 12" above roof.

G. Extend interior building systems drainage piping (sanitary, storm and lab waste) to 5'-0" outside building exterior. Extension from this point to site drainage system shall be provided as part of work of DIVISION 2. Plumbing contractor to make final connection site connections.

H. Upon completion of work and before final acceptance by Owner, clean floor drains and sediment buckets.

I. Exterior roof-mounted piping systems shall be supported by MAPA Support Products manufactured for exposed roof systems, or equal. Model MS-5 with retaining strap.

3.3 TRAP PRIMER PIPING

A. Install priming piping to floor drains so as to NOT trap each piping section.

B. If primer piping can NOT be installed in ceiling spaces because of primer connection elevation combined with structural conditions (i.e., deep beams adjacent to floor drains), install one of following:

1. Install deep traps with primer connection, in lieu of floor drains with primer connections. Distance from floor drain to trap shall NOT exceed 24".
2. Install piping in concrete floor slab.
3. For slab-on-grade conditions, install piping in earth below concrete floor slab.

C. Length of primer piping from primer valve to floor drain shall be maximum 25 feet or as recommended by primer valve manufacturer.

3.4 INSTALLATION OF SUPPLY, RETURN AND VACUUM

A. Domestic (cold, hot, recirculated), Lab (cold, hot, recirculated), Lab Air, Lab Vacuum and RO/DI piping shall be run together, parallel to each other and to building line, and shall pitch upward in direction of flow. Piping systems shall be completely drainable.

B. Provide ½" hose end drain valves at low points. Branch piping connections to mains shall be arranged to facilitate venting and draining of system. Provide shutoff valve for each branch and for each group of fixtures. Provide other valves indicated to isolate any part of system. Valves shall be installed above accessible ceilings, if possible.

C. Water hammer arresters shall have shutoff valves arranged to permit replacement of arresters and shall conform to Plumbing and Drainage Institute and Drainage Institute Standard PDI-WH-201. Arrester sizes shall be verified by manufacturer. Arresters shall be located below lavatories and to side of waste and water piping, if possible. Provide arresters in following locations:

1. At top of every cold water riser serving toilet room.
2. On every cold water branch serving flush valve.
3. Ahead of every quick-closing valve, i.e., 1/4 turn faucets, clothes washers, solenoid valves, etc.

D. Upon completion of piping and fixture installation, test run entire system to check that:

1. Faucets, flush valves and shower valves work properly.
2. Aerators are clean.
3. Hot water supply temperatures are properly regulated.
4. Hot water recirculating system is balanced, adjusted and functioning properly.
5. Entire system is free of leaks.

3.5 INSTALLATION OF GAS PIPING

A. Horizontal runs shall be level or pitched slightly to dirt legs.

B. Branch piping shall be taken off from top of mains. Provide dirt leg at bottom of each piping drop to boiler, heaters, and other gas-burning equipment.

C. Gas piping exterior to building and exposed to weather (e.g., service piping at meter) shall have zinc-rich primer and two coats of VOC-compliant epoxy. (VOC = Volatile Organic Compounds)

D. Mount gas emergency off switches and pushbuttons, at handicapped heights.

E. Provide lubricated plug valve on service entrance pipe located at meter. Provide red lamicoid label adjacent to valve, to read:

EMERGENCY SHUTOFF VALVE

F. Gas Pipe Testing and Purging Procedures

1. Pressure Testing: The building piping shall be pressure tested in accordance with the National Fuel Gas Code (NFPA-54). The test medium shall be nitrogen (N_2), carbon dioxide (CO_2) or air. The test pressure and duration must be approved by the local authority having jurisdiction and the Local Gas Distribution Company (LDC).
2. Purging and Placing Gas Piping into Operation: Upon notification and meter being turned on by Local Distribution Gas Company, the house line can be placed in operation. All purging shall be done in accordance with NFPA-54.

    a. The air can be safely displaced with natural gas provided that a moderately rapid and continuous flow of gas is introduced at the meter and air is vented to the outside of the building by means of connecting a rigid pipe or a semi-rigid metallic tubing with appropriate fittings.
    b. The purge piping must be located outside of the building at a safe distance away from fresh air intakes and away from any sources of ignition. The end of the purge riser must be equipped with a flash back arrester. The purge riser must be manned at all times. A fire extinguisher must be placed nearby while purging is in operation. A combustible gas indicator (CGI) can be used to assure the house line is purged properly to 100% gas.
    c. In the event of multi-floor house lines, the longest house line (furthest from the meter) must be purged first, followed by the next longest, until all sections of house lines have been purged to 100% gas.

3. Odorant Level: All house lines must be continuously purged until such a time that the odorant level is sufficiently detectable by smell and confirmed with an odorant level instrument such as a Bacharach Model 5110-200, or equivalent. The instrument shall have a range of 0 to 1.2% gas in air. The line must be purged until a readily detectable odorant reading of 0.25% or less gas in air is maintained.

a. As soon as the acceptable odorant level reading is maintained at all purging locations, turn off the ends of house lines, disconnect the purging tubing, permanently plug all ends and leak test all plugs. Gas utilization equipment can now be purged and placed into operation.
b. Odorant level readings shall be re-taken periodically to ensure proper level of odorant is maintained. Odorant level may decay especially in low flow house lines. If this occurs, purging procedures must be repeated as needed.

3.6 IDENTIFICATION

A. Refer to SECTION 230553, BASIC MATERIALS & METHODS - MECHANICAL, paragraph IDENTIFICATION.

B. Valves concealed in ceilings shall be identified with ceiling markers, Brady "Valve Finder Ceiling Tacks" or acceptable equivalent. Ink, crayon and similar marked identification will NOT be acceptable.

3.7 EQUIPMENT FURNISHED BY OTHERS

A. Install automatic control valves, sensor wells, and other pipeline devices furnished under CONTROL WORK SECTIONS.

3.8 CONNECTIONS TO SPECIAL EQUIPMENT

A. Make final plumbing connections to special equipment which is furnished and set in place under other SECTIONS in this DIVISION, under other DIVISIONS and by the Owner, including following:

1. HVAC equipment specified under HVAC EQUIPMENT sections.
2. Fire protection equipment specified under FIRE PROTECTION TRADE WORK and FIRE PROTECTION SPECIALTY sections.
3. Laboratory equipment specified under DIVISION 11.
4. Shop equipment furnished by the Owner.
5. Ice maker specified under DIVISION 11.
6. Photographic laboratory equipment specified under DIVISION 11.

B. Coordinate and verify equipment locations and connections with work of DIVISION 11, HVAC TRADE WORK and FIRE PROTECTION TRADE WORK. Refer to Architectural Drawings and equipment shop drawings for complete connection schedules, locations, and special installation details.

C. Holes and penetrations in equipment necessary for plumbing connections shall be provided as part of work of the Section furnishing the equipment.

D. Equipment shall be furnished and set in place as part of work of the Section furnishing the equipment. Work of this Section shall include:

1. Connections for plumbing services, as required by equipment, and associated piping from plumbing service location to equipment location.
2. Indirect waste piping from equipment to floor drains, whether shown on Contract Drawings or not.

3. Installation of reducing valves, vacuum breakers, solenoid valves, air gaps, and miscellaneous fittings furnished with the equipment but not mounted to the equipment.
4. Associated piping, stops, traps, tailpieces, valves, adapters, unions, water hammer arresters, backflow preventers, and standard plumbing accessories.

E. Specialty plumbing items necessary for proper operation of equipment which are not indicated on Contract Documents shall be furnished as part of work of DIVISION 11, EQUIPMENT and shall be installed as part of work of this Section.

F. Refer to Architectural Drawings and Equipment Supplier's drawings for special installation details.

3.9 STARTUP AND ADJUSTMENT

A. Startup of equipment shall be performed according to manufacturer's recommendations. Startup and adjustment shall include services required to check out, test and balance all devices to ensure proper sequencing of operation, prior to instruction of the Owner's maintenance personnel.

B. Prior to startup, equipment shall be checked for physical damage, loose connections, loose parts, leaks and other defects, and defects shall be corrected.

C. Furnish startup/adjustment services by manufacturer, for following equipment. Manufacturer shall be responsible for supervising and inspecting equipment installation and for equipment startup and adjustment. Submit written reports to Architect certifying that such procedures have been completed and including pertinent information; refer to paragraph.

1. Circulators
2. Booster pumps
3. Water heaters
4. Sump pumps
5. Vacuum pumps
6. Air compressors
7. RODI water system
8. Emergency gas shut-off units

END OF SECTION 220000

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SECTION 220442

SUMP PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sump pumps for the building storm drainage systems.

B. Related Sections include the following:

1. Division 23 Section "Motors" for sump pump motors.

1.3 SUBMITTALS

A. Product Data: Include performance curves, furnished specialties, and accessories for each type and size of pump indicated.

B. Shop Drawings: Show layout and connections for pumps. Include setting drawings with templates, directions for installing foundation and anchor bolts, and other anchorages.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For each type and size of pump specified to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on specific manufacturer types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered. Refer to Division 1 Section "Alternates."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's rigging instructions for handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Submersible Sump Pumps:

a. Stancor Pump Co.
b. See Water Inc.

2.2 SUMP PUMPS, GENERAL

A. Description: Factory-assembled and -tested, single-stage, centrifugal, end-suction sump pump units complying with UL 778. Include motor, operating controls, and construction for permanent installation.

B. Discharge Pipe End Connections NPS 2 and Smaller: Threaded. Pumps available only with flanged-end discharge pipe may be furnished with threaded companion flanges.

C. Motors: Single speed, with grease-lubricated ball bearings, and non-overloading through full range of pump performance curves.

D. Finish: Manufacturer's standard paint applied to factory-assembled and -tested units before shipping.

E. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembling and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

2.3 SUBMERSIBLE SUMP PUMPS SP-1

A. Submersible sump pump shall be manufactured by Stancor, Model Number SE-50, with capacity of 74 GPM at a total head of 37 feet and shall have a motor of 1 HP operating at 3600 RPM. Motor shall be 115 Volt, single –phase, 60 Hz.

B. Description: Submersible, direct-connected sump pump complying with HI 1.1-1.5 for submersible sump pumps.

1. Pump Arrangement: Simplex.
2. The motor housing shall be constructed of #304 stainless steel and mechanical seats shall be housed in a separate oil-filled compartment.
3. The main control shall be approved to UL 508 standards and housed in a gasketed Nema 4X enclosure with a see-through window for observation of operating functions. The control shall be equipped with an 8-pin twist lock receptacle, dual solid state Oil-Minder relays with variable sensitivity settings, an over current relay, self-cleaning stainless steel sensor probe, high decibel warning horn with alarm silencing switch, dual floats, clearly marked terminal board and remote monitoring contact. A Nema 4X junction box with 8-pin twist-lock electrical receptacle and 25' (additional lengths available in 25' increments) of mating 8 conductor cable shall be provided. All cables between the pump and junction box shall be 16' long and the cable and plug from the control unit shall be 8' long. The control unit, junction box, pump, floats and sensor shall be factory assembled as a complete, ready-to-use system and shall be tested and approved as a complete system by a nationally recognized testing laboratory such as ENTELA. The system shall allow for the main control to be located outside of the elevator hoistway to be monitored for all functions without having to enter the elevator shaft.

2.4 GENERAL-DUTY VALVES

A. Refer to Division 23 Section "Valves" for general-duty gate, ball, butterfly, globe, and check valves. Use valves specified for domestic water, unless otherwise indicated. Include features and devices indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of plumbing piping systems to verify actual locations of piping connections before pump installation.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.3 CONCRETE

A. Install concrete bases of dimensions indicated for sump pumps. Refer to Division 3 Section "Cast-in-Place Concrete" and Division 23 Section "Basic Mechanical Materials and Methods."

3.4 INSTALLATION

A. Install pumps according to manufacturer's written instructions.

B. Install pumps and arrange to provide access for maintenance, including removal of motors, impellers, couplings, and accessories.

C. Support piping so weight of piping is not supported by pumps.

3.5 CONNECTIONS

A. Install electrical connections for power, controls, and devices.

B. Electrical power and control components, wiring, and connections are specified in Division 26 Sections.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B

3.6 ADJUSTING

A. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.

3.7 COMMISSIONING

A. Final Checks before Starting: Perform the following preventive maintenance operations:

1. Lubricate bearings.
2. Fused disconnect couplings and check motors for proper direction of rotation.
3. Verify that each pump is free to rotate by hand. Do not operate pump if it is bound or drags, until cause of trouble is determined and corrected.
4. Verify that pump controls are correct for required application.

B. Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:

1. Start motors.
2. Open discharge valves slowly.
3. Check general mechanical operation of pumps and motors.

END OF SECTION 220442

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SECTION 221100 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes domestic water piping and water meters inside the building.

B. Water meters will be furnished and installed by utility company.

C. Water meters will be furnished by utility company for installation by Contractor.

D. Related Sections include the following:

1. Division 2 Section "Water Distribution" for water-service piping outside the building from source to the point where water-service piping enters the building.
2. Division 22 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
3. Division 22 Section "Plumbing Specialties" for water distribution piping specialties.

1.3 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Samples: Specified in Part 3 "Cleaning" Article.

C. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 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.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.4 CPVC PIPING

A. CPVC Schedule 40 & 80 Pipe: ASTM F 441/F 441M.

1. CPVC Schedule 40 Fittings: ASTM F 438, socket type.
2. CPVC Schedule 80 Fittings: ASTM F 439, socket type.

B. All pipe and fittings are to be produced by a single manufacturer and be installed in accordance with manufacturer's recommendations and local code requirements.

C. CPVC pipe and fittings shall be "Flowguard Gold" manufactured by Charlotte Pipe and Foundry or approved equal. Pipe and Fittings shall be provided with 25 year warranty.

2.5 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Division 23 Section "Valves."

B. Balancing and drain valves are specified in Division 23 Section "Plumbing Specialties."

C. CPVC Union Ball Valves: MSS SP-122, with full-port ball, socket detachable end connectors, and pressure rating not less than 125 psig at 73 deg F.

D. CPVC Non-Union Ball Valves: MSS SP-122, with full- or reduced-port ball, socket or threaded ends, and pressure rating not less than 125 psig at 73 deg F.

E. CPVC Butterfly Valves: With lever handle and pressure rating not less than 150 psig at 73 deg F.

F. CPVC Check Valves: Swing or ball-check design and pressure rating not less than 150 psig at 73 deg F.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 2 Section "Water Distribution."

E. Domestic Water Piping on Service Side of Water Meter inside the Building: Use any of the following piping materials for each size range:
1. NPS 4 to NPS 6: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
2. NPS 8: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.

F. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 and Smaller: Soft copper tube, Type K; copper pressure fittings; and soldered joints.

G. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

1. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. NPS 1 and Smaller: CPVC, SDR 11 tubing system and solvent-cemented joints.
3. NPS 1-1/4 and NPS 1-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
4. NPS 1-1/4 and NPS 1-1/2: CPVC, SDR 11 tubing system and solvent-cemented joints.NPS 2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
5. NPS 2 to 2 1/2: CPVC, SDR 11 piping system and solvent-cemented joints.
6. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
7. NPS 3 to NPS 3-1/2: CPVC, Schedule 80 pipe; CPVC, Schedule 80 socket fittings; and solvent-cemented joints.
8. NPS 4 to NPS 6: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.

3.3 NPS 4 to NPS 6: CPVC, Schedule 80 pipe; CPVC, Schedule 80 socket fittings; and solvent-cemented joints.VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Cast-iron, grooved-end valves may be used with grooved-end piping.

C. CPVC ball, butterfly, and check valves may be used in matching piping materials.Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Plumbing Specialties."

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 23 Section "Meters and Gages," and drain valves and strainers are specified in Division 23 Section "Plumbing Specialties."

E. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Division 23 Section "Plumbing Specialties."

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Solvent Weld Joints: Use approved solvent cement conforming to ASTM F-493 and primer conforming to ASTM F-656.

3.6 WATER METER INSTALLATION

A. Rough-in domestic water piping and install water meters according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

C. Install water meters according to AWWA M6 and utility's requirements.

1. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
2. Install turbine-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.
3. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on.
4. Install remote registration system according to standards of utility and of authorities having jurisdiction.

3.7 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."

B. Pipe hanger and support devices are specified in Division 23 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 23 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

G. Install supports for vertical copper tubing every 10 feet.

H. Install hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

I. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:

1. Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 23 Section "Plumbing Fixtures."
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to certified Testing Laboratory. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221100

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SECTION 221300 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections include the following:

1. Division 22 Section 226600 "Laboratory Waste and Vent" for chemical-waste and vent piping systems.
2. Division 22 Section 221500 "Sewage Pumps."

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water
2. Sanitary Sewer, Force-Main Piping: 100 psig

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer

PART 2 - PRODUCTS

2.1 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.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Cellular-Core, Sewer and Drain Series, PVC Pipe: ASTM F 891, Series PS 100.

1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Series PS 100 sewer and drain pipe.

2.5 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Dallas Specialty & Mfg. Co.
b. Fernco, Inc.
c. Logan Clay Products Company (The).
d. Mission Rubber Co.
e. NDS, Inc.
f. Plastic Oddities, Inc.

2. Sleeve Materials:

a. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
b. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: 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.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Mission Rubber Co.

C. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. ANACO.
b. Or Equal

D. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser, Inc.; DMD Div.
c. EBAA Iron Sales, Inc.
d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
e. JCM Industries, Inc.
f. Romac Industries, Inc.
g. Smith-Blair, Inc.
h. Viking Johnson.

2. Center-Sleeve Material: Stainless steel
3. Gasket Material: Natural or synthetic rubber.
4. Metal Component Finish: Corrosion-resistant coating or material.

E. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.

1. Manufacturers:

a. EBAA Iron Sales, Inc.
b. Or Equal

F. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

   a. EBAA Iron Sales, Inc.
   b. Romac Industries, Inc.
   c. Star Pipe Products; Star Fittings Div.

G. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

   a. SIGMA Corp.
   b. Or Equal

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: [Flexible,] [Shielded,] [Rigid, unshielded,] nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: [Flexible,] [Shielded,] nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3. Dissimilar Pipe-Material Couplings: [Flexible,] [Shielded,] [Rigid, unshielded,] nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

E. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: [Flexible,] [Shielded,] nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Cellular-core ABS pipe, ABS socket fittings, and solvent-cemented joints.
2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Cellular-core, Sewer and Drain Series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: [Flexible,] [Shielded,] [Rigid, unshielded,] nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Solid-wall, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
2. Cellular-core, Sewer and Drain Series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: [Flexible,] [Shielded,] nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be the following:

1. Steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 be any of the following:

1. Steel pipe, pressure fittings, and threaded joints.
2. Grooved-end steel pipe, grooved-joint system fittings and couplings, and grooved joints.

J. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:

1. Steel pipe, pressure fittings, and threaded joints.

    a. Include grooved-joint system fittings and couplings and grooved joints where indicated.

2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron fittings; glands, gaskets, and bolts; and mechanical joints.

    a. Include grooved-joint system fittings and couplings and grooved joints where indicated.

3. Push-on-joint, ductile-iron pipe; push-on-joint ductile-iron fittings; gaskets; and gasketed joints.

    a. Include grooved-joint system fittings and couplings and grooved joints where indicated.

4. Pressure pipe couplings, if dissimilar pipe materials or piping with small difference in OD must be joined.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 2.

B. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in **Division 23 Section "Mechanical Vibration and Seismic Controls."**

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."

G. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 1/4" per foot downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: ¼" per foot downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

M. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

N. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

O. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 23 Section "Valves."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 and smaller.
2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valves are specified in Division 22 Section "Plumbing Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in **Division 23 Section "Mechanical Vibration Controls and Seismic Restraints."**

B. Pipe hangers and supports are specified in Division 23 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

C. Install supports according to Division 23 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install supports for vertical steel piping every 15 feet.

G. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.

H. Install supports for vertical ABS and PVC piping every 48 inches.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main or sanitary manhole.
2. Sewage Pumps: To sewage pump discharge.

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221300

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SECTION 221400 - FUEL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fuel gas piping, specialties, and accessories within the building.

B. Related Sections include the following:

1. Division 23 Section "Meters and Gages" for pressure gages.

1.3 PROJECT CONDITIONS

A. Gas System Pressures: Natural Gas at a pressure of 0.5 psig or less.

B. Design values of fuel gas supplied for these systems are as follows:
1. Nominal Heating Value: 1000 Btu/cu. ft..
2. Nominal Specific Gravity: 0.6.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
2. Pressure regulators. Include pressure rating, capacity, and settings of selected models.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

C. Maintenance Data: For LP gas specialties and accessories to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ANSI Standard: Comply with ANSI Z223.1, "National Fuel Gas Code."

C. FM Standard: Provide components listed in FM's "Fire Protection Approval Guide" if specified to be FM approved.

D. IAS Standard: Provide components listed in IAS's "Directory of A. G. A. and C. G. A Certified Appliances and Accessories" if specified to be IAS listed.

E. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" if specified to be UL listed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Appliance Connector Valves:

   a. American Valve.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Jomar International, Ltd.
   d. Mueller Co.; Mueller Gas Products Div.
   e. Watts Industries, Inc.; Water Products Div.

2. Gas Valves, NPS 2 and Smaller:

   a. Crane Valves.
   b. Grinnell Corp.
   c. Jomar International, Ltd.
   d. Milwaukee Valve Co., Inc.
   e. Mueller Co.; Mueller Gas Products Div.
   f. Nibco, Inc.
   g. Watts Industries, Inc.; Water Products Div.

3. Plug Valves, NPS 2-1/2 and Larger:

   a. Milliken Valve Co., Inc.
   b. Nordstrom Valves, Inc.
   c. Olson Technologies, Inc.; Homestead Valve Div.
   d. Walworth Co.

4. Electrically Operated Gas Valves:

   a. ASCO General Controls.
   b. Automatic Switch Co.
   c. Isimet

d. Magnatrol Valve Corp.
e. Parker Hannifin Corp.; Climate & Industrial Controls Group; Skinner Valve Div.

5. Appliance Pressure Regulators:

a. Eaton Corp.; Controls Div.
b. Harper Wyman Co.
c. Maxitrol Co.
d. SCP, Inc.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

A. Steel Pipe: ASTM A 53; Type E or S; Grade B; Schedule 40; black.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
4. Joint Compound and Tape: Suitable for natural gas.
5. Steel Flanges and Flanged Fittings: ASME B16.5.
6. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Transition Fittings: Type, material, and end connections to match piping being joined.

C. Common Joining Materials: Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

2.4 PIPING SPECIALTIES

A. Flexible Connectors: ANSI Z21.24, copper alloy.

B. Quick-Fused disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.

2.5 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

G. General-Duty Valves, NPS 2-1/2 and Larger: ASME B16.38, cast-iron body, suitable for fuel gas service, with "WOG" indicated on valve body, and 125-psig pressure rating.

1. Gate Valves: MSS SP-70, OS&Y type with solid wedge.
2. Butterfly Valves: MSS SP-67, lug type with lever handle.

H. Electrically Operated Gas Valves: UL 429, aluminum body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed; ASCO #8215.

2.6 PRESSURE REGULATORS

A. Description: Single stage and suitable for natural gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
3. Service Pressure Regulators: ANSI Z21.80. Include 100-psig minimum inlet pressure rating.
4. Line Pressure Regulators: ANSI Z21.80 with 10-psig inlet pressure rating.
5. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

B. Pressure Regulator Vents: Field-installed, corrosion-resistant screen in opening if not connected to vent piping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

B. Comply with ANSI Z223.1, "Prevention of Accidental Ignition" Paragraph.

3.2 SERVICE ENTRANCE PIPING

A. Extend natural gas piping and connect to natural gas distribution for service entrance to building.

1. Exterior natural gas distribution system piping will be provided by contractor.

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for dielectric fittings.

3.3 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Natural Gas Piping, 0.5 psig or Less: Use the following:

1. NPS 2 and smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

C. Underground Fuel Gas Piping: Steel pipe, steel welding fittings, and welded joints. Encase in containment conduit.

D. Containment Conduits: Steel pipe, steel welding fittings, and welded joints.

3.4 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas valve.

C. Piping Line Valves, NPS 2 and Smaller: Gas valve.

D. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

E. Valves at Service Meter, NPS 2 and Smaller: Gas valve.

F. Valves at Service Meter, NPS 2-1/2 and Larger: Plug valve.

3.5 PIPING INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with gooseneck end and screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
2. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in masonry walls, subject to approval of authorities having jurisdiction.
3. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

    a. Exception: Accessible above-ceiling space specified above.

C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

E. Install fuel gas piping at uniform grade of 1/4" per 15 linear feet (1.6 percent) slope upward toward risers.

F. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

G. Connect branch piping from top or side of horizontal piping.

H. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

I. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

J. Install pressure gage upstream and downstream from each line pressure regulator.

K. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.

L. Install vent piping for gas pressure regulators, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

M. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.

3.6 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Use materials suitable for fuel gas.

1. Brazed Joints: Make with brazing alloy with melting point greater than 1000 deg F. Brazing alloys containing phosphorus are prohibited.

3.7 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 23 Section "Hangers and Supports" for pipe hanger and support devices.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.

C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

E. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
2. Do not use gas pipe as grounding electrode.

3.9 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.

1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
2. Refer to Division 23 Section "Basic Mechanical Materials and Methods", "Mechanical Identification" for nameplates and signs.

3.10 PAINTING

A. Use materials and procedures in Division 9 Section "Painting," "Exterior Paint Schedule" Article, "Ferrous Metal" Paragraph, "Full-Gloss, Alkyd-Enamel Finish" Subparagraph.

B. Paint exterior service pressure regulators, and specialty valves. Paint shall be comprised of zinc-rich primer and two coats of VOC compliant epoxy.

1. Color: Gray.

3.11 FIELD QUALITY CONTROL

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

D. Verify capacities and pressure ratings of valves, and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

3.12 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 221400

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SECTION 221500 - SEWAGE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sewage pumps for the building sanitary drainage systems.

B. Related Sections include the following:

1. Division 23 Section "Motors" for sewage pump motors.

1.3 SUBMITTALS

A. Product Data: Include performance curves, furnished specialties, and accessories for each type and size of pump indicated.

B. Shop Drawings: Show layout and connections for pumps. Include setting drawings with templates, directions for installing foundation and anchor bolts, and other anchorages.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For each type and size of pump specified to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on specific manufacturer types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's rigging instructions for handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Packaged, Sewage Pump Units:

a. Goulds Pumps, Inc.
b. Hydromatic
c. Weil Pumps

2.2 SEWAGE PUMPS, GENERAL

A. Description: Factory-assembled and -tested, single-stage, centrifugal, end-suction sewage pump units complying with UL 778. Include motor, operating controls, and construction for permanent installation.

B. Discharge Pipe End Connections NPS 2 and Smaller: Threaded. Pumps available only with flanged-end discharge pipe may be furnished with threaded companion flanges.

C. Discharge Pipe End Connections NPS 2-1/2 and Larger: Flanged.

D. Motors: Single speed, with grease-lubricated ball bearings, and non-overloading through full range of pump performance curves.

E. Finish: Manufacturer's standard paint applied to factory-assembled and -tested units before shipping.

F. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembling and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

2.3 PACKAGED, SEWAGE PUMP UNITS SP-1

A. Packaged, Duplex Sewage Pumps Units shall be manufactured by Goulds Pump, Model Number 3SD52G4CA, with capacity of 206 GPM at a total head of 26 feet and shall have a motor of 2 HP, operating at 1750 RPM. Motor shall be 460 Volt, three–phase, 60 Hz. Pump basin shall be cast concrete (by others), 6'x6'x4.56'.

B. Description: Packaged, automatic-operation, duplex-arrangement, grinder sewage pumps complying with HI 1.1-1.5 for wet-pit-volute sewage pumps; with cast-iron bodies, silicon bronze impellers, pump alternation, and control panel.

1. Mechanical Pump Seals: The motor shall be protected by two independent sets of mechanical shaft seals mounted in tandem on the pump shaft. Pump designs with one or two springs acting between rotating faces shall not be allowed as this design would allow effluent to force the seal faces apart during periods of upset or high discharge pressure.

The outer mechanical seal shall be constructed of Silicon Carbide vs. Silicon Carbide (or lower seal optional silicon carbide vs. tungsten carbide) sealing faces. The inner mechanical seal shall be constructed of Carbon vs. Ceramic sealing faces. Each set (upper and lower) shall be tensioned by an independent spring system constructed of series 300 stainless steel metal components and BUNA-N elastomers. The mechanical seals shall be located in a completely isolated seal oil chamber which will provide lubrication for the seal faces while simultaneously acting as an isolation zone for the stator chamber. This seal oil chamber shall be provided with an internally mounted moisture sensing probe to detect moisture intrusion into this lower chamber of the pump. The moisture sensing probe must be connected to an "optional" seal fail circuit (also referred to as a moisture detection circuit) in the control panel. The seal fail circuit option should have an alarm light, audible alarm or both. This seal fail alarm signals that service is required.

2. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; and three-conductor waterproof power cable of length required, with grounding plug and cable-sealing assembly for connection at pump. The ball bearings shall be designed for a B-10 life of 30,000 hours minimum.
3. Basin: By others
4. Controls: Automatic, with mercury-float switches and 20-foot, waterproof, electrical power cables.
5. Pump Discharge Piping: Manufacturer's standard steel pipe, or copper tube.
6. Float Switches: 4 float switches wired for "pumps off", "lead on", "lag on", and "alarm" sequencing. Provide with Goulds model #FSB1 float switch mounting bracket.
7. Guide Rail System: Connect to 3" pump outlet with 125# ANSI flanged discharge. Outlet shall be 4" flanged discharge. Goulds Pumps Model #A10-30.

8. Control Panel: Wall mounted, Duplex liquid level controller, UL Listed.

   a. Provide fully automatic operation for two pumps. Alternates pump starting to distribute operating time. Provide extra pumping capacity in times of high inflow by energizing both pumps.
   b. Hinged door with lockable stainless steel latch for safe operation indoors or out.
   c. High level alarm circuit includes through door mounted silence switch for manual silence of alarm horn.
   d. Through door mounted alarm test switch insures proper operation of the alarm circuit without the need to open the panel.
   e. 2 through door mounted pump run lights.
   f. Top mounted high intensity flashing red light provides 360° visibility.
   g. Pulsating, corrosion proof alarm horn.
   h. Wired for operation with three float bulbs. Field modified for four float bulb operation using separate "lag-on" and "alarm bulbs".
   i. Alternator selector switch allows a choice of automatic alternation or operation of only pump 1 or pump 2. Typically used if one pump is down for maintenance.
   j. Lag pump start delay built-in. Delays starting lag pump for 5 seconds if both pumps attempt to start simultaneously as after a power outage.
   k. Panel can be wired for a single power feed for pumps and control circuit or the control circuit can be wired to a separate power supply to insure alarm integrity in case of a tripped main breaker.
   l. Auxiliary alarm contacts provided for remote alarm connection.

9. Valves: Factory- or field-installed check and shutoff valves on each pump discharge.

2.5 GENERAL-DUTY VALVES

A. Refer to Division 23 Section "Valves" for general-duty gate, ball, butterfly, globe, and check valves. Use valves specified for domestic water, unless otherwise indicated. Include features and devices indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of plumbing piping systems to verify actual locations of piping connections before pump installation.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 2.

3.3 CONCRETE

A. Install concrete bases of dimensions indicated for sewage pumps. Refer to Division 3 Section "Cast-in-Place Concrete" and Division 23 Section "Basic Mechanical Materials and Methods."

3.4 INSTALLATION

A. Install pumps according to manufacturer's written instructions.

B. Install pumps and arrange to provide access for maintenance, including removal of motors, impellers, couplings, and accessories.

C. Support piping so weight of piping is not supported by pumps.

D. Submersible Sewage Pumps: Set pumps on basin floor. Make direct connections to sanitary drainage piping.

1. Anchor quick-fused disconnect systems to bottom of basins and basin sidewalls or covers. Install pumps so pump and discharge pipe disconnecting flanges make positive seals when pumps are dropped into place.

E. Sewage Pump Basins: By Structural Engineer.

F. Packaged Pump Units: Install and make direct connections to drainage and vent piping.

3.5 CONNECTIONS

A. Sanitary drainage and vent piping installation requirements are specified in Division 22 Section "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

1. Install discharge pipe sizes equal to or greater than diameter of pump nozzles, and connect to sanitary drainage piping.
2. Install swing check valve and gate or ball valve on each sewage pump discharge. Include spring-loaded or weighted-lever check valves for piping NPS 2-1/2 and larger.
3. Install swing check valve and gate or ball valve on each automatic, packaged pump discharge.

B. Install electrical connections for power, controls, and devices.

C. Electrical power and control components, wiring, and connections are specified in Division 16 Sections.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 ADJUSTING

A. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.

3.7 COMMISSIONING

A. Final Checks before Starting: Perform the following preventive maintenance operations:

1. Lubricate bearings.
2. Fused disconnect couplings and check motors for proper direction of rotation.
3. Verify that each pump is free to rotate by hand. Do not operate pump if it is bound or drags, until cause of trouble is determined and corrected.
4. Verify that pump controls are correct for required application.

B. Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:

1. Start motors.
2. Open discharge valves slowly.
3. Check general mechanical operation of pumps and motors.

END OF SECTION 221500

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SECTION 221600 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following storm drainage (including primary and secondary) piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures".

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Mission Rubber Co.
3) Tyler Pipe; Soil Pipe Div.

2.5 SPECIAL PIPE FITTINGS

A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:

a. Mission Rubber Co.
b. NDS, Inc.

2. Sleeve Materials:

   a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   b. For Dissimilar Pipes: Material compatible with pipe materials being joined.

B. Shielded Nonpressure Pipe Couplings: 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.

1. Manufacturers:

   a. Cascade Waterworks Mfg. Co.
   b. Mission Rubber Co.

C. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.

1. Manufacturers:

   a. Cascade Waterworks Mfg. Co.
   b. Dresser, Inc.; DMD Div.
   c. EBAA Iron Sales, Inc.

2. Center-Sleeve Material: Ductile iron.
3. Gasket Material: Natural or synthetic rubber.
4. Metal Component Finish: Corrosion-resistant coating or material.

D. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

   a. EBAA Iron Sales, Inc.
   b. Romac Industries, Inc.
   c. Star Pipe Products; Star Fittings Div.

E. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

1. Manufacturers:

   a. SIGMA Corp.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Aboveground storm drainage piping NPS 6 and smaller shall be the following:

1. Hubless cast-iron soil pipe and heavy-duty fittings; heavy-duty, shielded, stainless steel couplings; and heavy-duty coupled joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

B. Underground storm drainage piping NPS 6 and smaller shall be any of the following:

1. Hub and Spigot; Service class, cast-iron soil pipe and fittings; gasketed joints.
2. Cellular-core, Sewer and Drain Series, PVC pipe; PVC socket fittings; and solvent-cemented joints
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

3.3 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 2.

B. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."

D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Plumbing Specialties."

E. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

H. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

1. Building Storm Drain: 1/8" per foot downward in direction of flow for piping NPS 2-1/2 and smaller; 1/8" per foot downward in direction of flow for piping NPS 3 and larger.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 23 Section "Mechanical Vibration Controls and Seismic Restraints."

B. Pipe hangers and supports are specified in Division 23 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 23 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6: 60 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect storm drainage piping to roof drains and secondary storm drainage specialties.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221600

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SECTION 223000 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following plumbing specialties:

1. Backflow preventers.
2. Water regulators.
3. Balancing valves.
4. Water filters.
5. Thermostatic water mixing valves.
6. Water tempering valves.
7. Strainers.
8. Outlet boxes.
9. Washer-supply outlets.
10. Hose stations.
11. Key-operation hydrants.
12. Wheel-handle wall hydrants.
13. Trap seal primer valves.
14. Drain valves.
15. Miscellaneous piping specialties.
16. Flashing materials.
17. Cleanouts.
18. Floor drains.
19. Trench drains
20. Roof drains.

B. Related Sections include the following:

1. Division 23 Section "Meters and Gages" for water meters, thermometers, and pressure gages.

1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PE: Polyethylene plastic.
3. PUR: Polyurethane plastic.
4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig
2. Sanitary Waste and Vent Piping: 10-foot head of water.
3. Storm Drainage Piping: 10-foot head of water.
4. Force-Main Piping: 100 psig.

1.5 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Backflow preventers and water regulators.
2. Balancing valves, water filters, and strainers.
3. Thermostatic water mixing valves and water tempering valves.
4. Water hammer arresters, air vents, and trap seal primer valves and systems.
5. Drain valves, hose bibbs, hydrants, and hose stations.
6. Outlet boxes and washer-supply outlets.
7. Backwater valves, cleanouts, floor drains, open receptors, trench drains, and roof drains.
8. Air-admittance valves, vent caps, vent terminals, and roof flashing assemblies.
9. Grease interceptors, grease recovery units, oil interceptors, and solids interceptors.
10. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field test reports.

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators.
2. Water filters.
3. Thermostatic water mixing valves and water tempering valves.
4. Trap seal primer valves and systems.
5. Hose stations and hydrants.
6. Grease interceptors, grease recovery units, oil interceptors, and solids interceptors.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1.

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 BACKFLOW PREVENTERS

A. Manufacturers:

1. Watts Industries, Inc.; Water Products Div.

B. General: ASSE standard, backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel-plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Provide the following valves on inlet and outlet of backflow preventer:

a. Bronze gate valves on sizes ¾" to 3"
b. 4" and larger: Cast iron gate valves with flanged ends, with FDA approved lining.
c. 4" and larger: Cast iron gate valves with outside screw and yoke with flanged ends, with FDA approved lining where noted on plans.

2. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

G. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

H. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

I. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves.

J. Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, NPS 3/8.

K. Laboratory Faucet Vacuum Breakers: ASSE 1035, suitable for continuous pressure application and chrome plated; consisting of primary and secondary checks; intermediate vacuum breaker; and threaded ends, NPS 1/4 or NPS 3/8 as required.

L. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

1. Pressure Loss: 10 psig maximum, through middle 1/3 of flow range.

M. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

N. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.

O. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.3 WATER REGULATORS

A. Manufacturers:

1. Cla-Val Co.
2. Conbraco Industries, Inc.
3. FLOMATIC Corp.
4. IMI Cash Valve.
5. Watts Industries, Inc.; Water Products Div.
6. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE 1003, water regulators, rated for initial working pressure of 150 psig minimum. Include integral factory-installed or separate field-installed, Y-pattern strainer.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
b. Booster Heater Water Supply: Single-seated, direct operated with integral bypass.

2. NPS 2-1/2 and Larger: Bronze or cast-iron body with flanged ends. Include AWWA C550 or FDA-approved, interior epoxy coating for regulators with cast-iron body.

a. Type: Single-seated, direct operated.
b. Type: Pilot-operated, single- or double-seated, cast-iron-body main valve, with bronze-body pilot valve.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.

2.4 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

1. Manufacturers:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett.
d. Flow Design, Inc.
e. ITT Industries; Bell & Gossett Div.
f. Watts Industries, Inc.; Water Products Div.

2. NPS 2 and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
3. NPS 2 and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
4. NPS 2-1/2 and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

2.5 THERMOSTATIC WATER MIXING VALVES – FOR DOMESTIC HOT WATER SYSTEMS

A. Manufacturers:

1. Lawler Manufacturing Company, Inc.
2. Leonard Valve Company.
3. Symmons Industries, Inc.

B. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer.

1. Type: Liquid-filled motor, operation and pressure rating 100 psig minimum.

C. Thermostatic Water Mixing Valves: Unit, with the following:

1. Piping, valves, and unions. Include thermometer if not in cabinet.
2. Piping Component Finish: Polished chrome plate OR Rough bronze.

2.6 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and Smaller: Bronze body, with female threaded ends.

3. NPS 2-1/2 and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.

    a. Drain: Factory- or field-installed, hose-end drain valve.

5. T-Pattern Strainers: Malleable-iron or ductile-iron body with grooved ends; access end cap with drain plug and access coupling with rubber gasket.
6. Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.

    a. Type: Simplex with one basket
    b. Drain: Factory- or field-installed, hose-end drain valve.

B. Drainage Basket Strainers: Non-pressure-rated, cast-iron or coated-steel body; with bolted flange or clamp cover and drain with plug.

1. Basket: Bronze or stainless steel with 1/8- or 3/16-inch- diameter holes and lift-out handle.
2. Female threaded ends for NPS 2 and smaller, and flanged ends for NPS 2-1/2 and larger.

2.7 KEY-OPERATION HYDRANTS

A. Manufacturers:

1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Woodford Manufacturing Co.
5. Zurn Industries, Inc.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.

1. Inlet: NPS 3/4 or NPS 1 threaded or solder joint.
2. Outlet: ASME B1.20.7, garden-hose threads.
3. Operating Keys: Two with each key-operation hydrant.

C. Nonfreeze Exposed-Outlet Wall Hydrants: ASSE 1019, self-drainable with integral nonremovable hose-connection vacuum breaker or backflow preventer, casing and operating rod to match wall thickness, projecting outlet, and wall clamp.

1. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
2. Nozzle and Wall Plate Finish: Polished nickel bronze.

D. Nonfreeze Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker or backflow preventer, casing and operating rod to match wall thickness, concealed outlet, and wall clamp.

1. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.

2. Box and Cover Finish: Polished nickel bronze.

E. Hot and Cold, Nonfreeze Concealed-Outlet Wall Hydrants: With deep flush-mounting box with cover; hot- and cold-water casings and operating rods to match wall thickness; concealed outlet; wall clamps; and factory- or field-installed, nonremovable and manual drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.

1. Box and Cover Finish: Polished nickel bronze.
2. Box and Cover Finish: Polished chrome plate.

2.8 WHEEL-HANDLE WALL HYDRANTS

A. Manufacturers:

1. Sioux Chief Manufacturing Co., Inc.
2. Watts Industries, Inc.; Water Products Div.
3. Woodford Manufacturing Co.
4. Zurn Industries, Inc.; Jonespec Div.

B. Description: Frost-proof design similar to ASME A112.21.3M, for wall mounting with wheel-handle operation, NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, casing and operating rod to match wall thickness, and projecting outlet with ASME B1.20.7 garden-hose threads on outlet. Include wall clamp; integral vacuum breaker or nonremovable, drainable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose threads complying with ASME B1.20.7 on outlet.

2.9 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics: (Designation-TP)

1. Manufacturers:

a. Precision Plumbing Products, Inc. (Model P-1-500 or P-2-500)

2. 125-psig minimum working pressure.
3. Bronze body with atmospheric-vented drain chamber.
4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
7. Provide distribution unit when serving multiple drains.
8. Provide isolation valve on inlet side of trap primer.

B. Trap Primers

1. Provide trap primers with integral vacuum breaker:

a. Precision Plumbing Products #PR-500. Provide distribution unit #DU-2, 3 or 4 as required for multiple traps.
b. For each floor drain which is subject to trap evaporation.

2. Provide necessary piping for connection to floor drains.

2.10 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimums CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with NPS 1/8 side drain outlet and cap.

2.11 BACKWATER VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Watts Industries, Inc.; Drainage Products Div.
4. Zurn Industries, Inc.; Specification Drainage Operation.

C. Horizontal Backwater Valves: ASME A112.14.1, cast-iron body, with removable bronze swing-check valve and threaded or bolted cover.

1. Closed-Position Check Valve: Factory assembled or field modified to hang closed unless subject to backflow condition.
2. Open-Position Check Valve: Factory assembled or field modified to hang open for airflow.
3. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor, instead of cover.

D. Drain Outlet Backwater Valves: Cast-iron or bronze body, with removable ball float, threaded inlet, and threaded or spigot outlet for installation in bottom outlet of floor drain.

2.12 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

1. Manufacturers:

    a. Josam Co.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe; Wade Div.
    d. Zurn Industries, Inc.; Specification Drainage Operation.

B. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Manufacturers:

    a. Josam Co.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Co., Inc.
    d. Watts Industries, Inc.; Drainage Products Div.
    e. Watts Industries, Inc.; Water Products Div.
    f. Zurn Industries, Inc.; Wilkins Div.

C. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral or field-installed, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
2. Finish for Service Areas: Rough bronze.
3. Finish for Finished Rooms: Chrome or nickel plated.
4. Operation for Equipment Rooms: Wheel handle or operating key.
5. Operation for Service Areas: Wheel handle.
6. Operation for Finished Rooms: Operating key.
7. Include operating key with each operating-key hose bibb.
8. Include integral wall flange with each chrome- or nickel-plated hose bibb.

D. Air Vents: Float type for automatic air venting.

1. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 minimum inlet, 150-psig minimum pressure rating, and threaded vent outlet.

E. Roof Flashing Assemblies: Manufactured assembly made of 4-lb/sq. ft., 0.0625-inch thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

1. Available Manufacturers:
2. Open-Top Vent Cap: Without cap.

F. Open Drains: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting, joined with ASTM C 564, rubber gaskets.

G. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.

1. NPS 2: 4-inch- minimum water seal.
2. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

H. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

I. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

J. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

K. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

L. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

M. Conductor Nozzles: Bronze body with threaded inlet for connected conductor size, and bronze wall flange with mounting holes.

2.13 CLEANOUTS

A. Cleanouts : Comply with ASME A112.36.2M.

1. Application: Floor cleanouts and Wall cleanouts as follows:

a. For concealed piping in unfinished concrete floor in mechanical rooms and other limited-access areas: Wade #6000-X-TY-118 floor cleanout with scoriated heavy duty cast iron top, bronze gasket plug.
b. For concealed piping in slab-on-grade concrete, ceramic tile and quarry tile floors: floor cleanout with adjustable head, and round scoriated nickel-bronze tope with bronze gasket plug: Wade #6000-1-TY-118.
c. For concealed piping in slab-on-grade concrete under vinyl file floors: floor cleanout with adjustable head and recessed round nickel-bronze tope with bronze gasket plug: Wade #6000-1-Ty-118.
d. For concealed piping in slab-on-grade concrete under carpeted floors: floor cleanout with adjustable head, anchor flange and round scoriated nickel-bronze tope with bronze gasket plug: Wade #6000-1-118-TY-CM with carpet marker.

e. For concealed piping in finished walls: Wall cleanout with cleanout tee and bronze square access cover and frame: Wade #W-8480-S.
f. All cleanouts above finished (accessible and non-accessible) ceilings shall be extended to floor above within and accessible location.

2. Products:

a. Josam Co.;
b. Smith, Jay R. Mfg. Co..
c. Tyler Pipe, Wade Div.
d. Zurn Industries, Inc., Specification Drainage Operation

2.14 TRENCH DRAINS

A. Trench Drains, TD-1

1. Available Products:
2. Products:

a. Zurn Industries, Inc., Specification Drainage Operation; Z886-HR-DB.

3. Body Material: High Density Polyethylene (HDPE)
4. Seepage Flange: Anchor flange.
5. Clamping Device: Required.
6. Bottom dome strainer required.
7. Outlet: End.
8. Grate Material: White acid resistant ductile iron grate.
9. Dimensions of Frame and Grate: 80" long by 6" wide with 4" deep throat.
10. Top Loading Classification: Pedestrian traffic
11. Trap Material: CPVC, PP, or HDPE.
12. Trap Pattern: Standard P-trap.

2.15 FLOOR DRAINS

A. Install floor drains in all restrooms.

B. Provide floor drains with deep trap seals to minimize the need for trap primers. Provide trap assemblies with trap primer connections for floor drains where indicated on the drawings. Outlet type shall be Neo-Loc for on grade applications (connections to hub and spigot pipe), no-hub or Neo-Loc for above grade applications (connections to no-hub pipe).

C. Floor drains in public areas shall be cast iron body and flashing collar with closure plug, nickel bronze adjustable strainer head with secured round hole grate. Zurn Industries, Inc. Z-415 Series with "B" strainer.

D. Floor drains in non-public areas shall be heavy duty, cast iron body and 12±" cast iron grate, flashing flange and collar. Zurn Industries, Inc. 3z-541.

ROOF DRAINS

E. Roof Drains, RD-1 & RD-2

1. Application: Roof drainage
2. Available Products:

F. Type RD-1: Zurn roof drain Model Z125, cast iron construction with combination membrane flashing clamp/gravel guard and low silhouette cast iron dome.

G. Type RD-2 (Combination roof and overflow drain): Froet Industries Model 100C3-OFS

1. Compliance: ANSI/ASME A112.21.2M. and IAPMO IGC 187-2003
2. Body: Patented bi-functional body. Powder coated, ASTM A 48, Class 25 cast iron body with anchor flange.
3. Dome Strainer: Cast Iron strainer. Min: Free area of 136 square inches.
4. Membrane Clamp Ring: 2.375-inch wide, ASTM A 48, Class 25 cast iron, waterproofing membrane clamp ring with integral gravel stop.
5. Pipe Size: 3 inches
6. LP-Low profile roof drain 4" overflow height
7. OFS-Overflow Strainer: Debris strainer for overflow pipe
8. DC-Deck Clamp; underdeck clamp (used to secure drain to deck). Exterior clamp

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

D. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

E. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

F. Install expansion joints on vertical risers, stacks, and conductors if indicated or required by material expansion.

G. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.
5. Locate at connection to building sewer before exiting building wall.

H. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

I. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

J. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

K. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

L. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

M. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

N. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

O. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

P. Install grease recovery units on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction.

1. Install control panel adjacent to unit, unless otherwise indicated.

Q. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

R. Fasten recessed-type plumbing specialties to reinforcement built into walls.

S. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

T. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 23 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

U. Install air vents at piping high points. Include ball, gate, or globe valve in inlet and drain piping from outlet to floor drain.

V. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

W. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 22 Sections.

D. Interceptor Connections: Connect piping, flow-control fittings, and accessories.

1. Solids Interceptors: Connect inlet and outlet.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 5 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Delete from or add to plumbing specialty options in paragraph below to suit Project.

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign, as required. Refer to Division 23 Section "[Basic Mechanical Materials and Methods] [Mechanical Identification]" for nameplates and signs.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain interceptors and grease recovery units. Refer to Division 1.

END OF SECTION 223000

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SECTION 223500 - DOMESTIC WATER HEAT EXCHANGERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following heat exchangers:
   1. Circulating, storage heat exchangers.
   2. Heat-exchanger accessories.

1.3 SUBMITTALS

A. Product Data: For each type and size of heat exchanger indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Product Certificates: For each type of instantaneous heat exchanger, signed by product manufacturer.

D. Manufacturer Seismic Qualification Certification: Submit certification that heat exchangers, accessories, and components will withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls." Include the following:

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

      a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
      b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Source quality-control test reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of heat exchangers through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of heat exchangers and are based on the specific system indicated. Refer to Division 1.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Where ASME-code construction is indicated, fabricate and label heat-exchanger storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with water.

1.5 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of heat exchangers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including heat exchanger, storage tank, and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:

a. Circulating, Storage Heat Exchangers:

1) Storage Tank: twenty years.
2) Tube Coil: Five years.
3) Controls and Other Components: One year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CIRCULATING, STORAGE HEAT EXCHANGERS

A. Products:

1. PVI Industries model #900-N-300-A-QWD

B. Circulating, Storage Heat Exchangers:

1. Manufacturers:

a. PVI Industries, LLC.
b. Patterson Kelley
c. Adamson

2. Description: Packaged, large-capacity, hot-water storage tank with heat-exchanger coil, circulator, controls, and specialties for heating domestic water with water in coil.
3. Flow Pattern: Standard-flow arrangement, with water from bottom of storage tank circulated across heat-exchanger coil and returned to tank. Include hot-water outlet located at top of tank and temperature sensor in tank.
4. Flow Pattern: Reverse-flow arrangement, with water from storage tank drawn across heat-exchanger coil and returned to bottom of tank. Include hot-water outlet and temperature sensor located in or at coil shell.
5. Storage Tank Construction: ASME-code steel with 125-psig working-pressure rating. Include nozzle and head for heat-exchanger tube coil. The tank will be plated with electroless nickel (EN). The EN plating will be a high-phosphorus (10%) and nonporous composition suitable for submersion service (ASTM B773 standard may be used as a guideline). The finished lining will not require sacrificial anode rods.

a. Configuration: Vertical, 23" diameter manway configured so 100% of interior vessel can be inspected.
b. Manhole: 11 by 15 inches in sidewall of vertical storage tank shell.
c. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing and labeling.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

d. Lining: Electroless Nickel plate complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
e. Anode Rods: Not required
f. Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire storage tank and nozzle except connections and controls.

6. Heat-Exchanger Coil: double-wall, cupro-nickel, U tubes with tube sheet and supporting baffles.

   a. Heat-Exchanger Pressure Rating: Equal to or greater than heating-fluid supply pressure.

7. Temperature Control: Adjustable temperature aquastat, mounted in storage tank shell head, unless otherwise indicated.
8. Safety Control: Automatic, high-temperature-limit cutoff device or system. Include automatic low-water cutoff device or system.
9. Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3, for combination temperature and pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select one relief valve with sensing element that extends into storage tank.
10. Gages: Factory-mounted thermometer and pressure gage.
11. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.

    a. Pump Control: Sensor for operating pump and control valve.

12. Support: Factory mounted on skids.
13. Energy Management System Interface: Normally closed dry contacts for enabling and disabling heat exchanger.
14. Capacity and Characteristics:

    a. Capacity: 300 gal.
    b. Recovery: 710 gph at 100 deg F temperature rise.
    c. Hot-Water Temperature Setting: 120 deg F.
    d. Heating Hot-Water Supply:

       1) Inlet Temperature: 180 deg F.
       2) Outlet Temperature: 160 deg F.
       3) Pipe Size: 2" NPS.

    e. Condensate Pipe Size: 1" NPS.
    f. Electrical Characteristics:

       1) Volts: 120
       2) Phases: 1

3) Hertz: 60
4) Full-Load Amperes: 20

2.3 HEAT-EXCHANGER ACCESSORIES

A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of heat exchanger. Select relief valves with sensing element that extends into heat-exchanger storage tank.

B. Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include pressure setting less than working-pressure rating of heat exchanger.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect heat-exchanger storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial heat-exchanger storage tanks before shipment to minimum of one and one-half times pressure rating.

C. Prepare test reports.

PART 3 - EXECUTION

3.1 HEAT-EXCHANGER INSTALLATION

A. Install heat exchangers on concrete bases.

1. Concrete base construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."

B. Install heat exchangers level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Anchor heat exchangers to substrate.

D. Install seismic restraints for heat exchangers. Anchor to substrate.

E. Install temperature and pressure relief valves in top portion of storage tank shells of heat exchangers with domestic water storage. Use relief valves with sensing elements that extend into shells. Extend relief-valve outlet, with drain piping same as water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install combination temperature and pressure relief valves in water piping for heat exchangers without storage. Extend relief-valve outlet, with drain piping same as water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install heat-exchanger drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for heat exchangers that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.

H. Install thermometer on each heat-exchanger domestic-water inlet and outlet piping, and install thermometer on each heat-exchanger heating-fluid inlet and outlet piping. Refer to Division 23 Section "Meters and Gages" for thermometers.

I. Install pressure gages on heat-exchanger heating-fluid piping. Refer to Division 23 Section "Meters and Gages" for pressure gages.

J. Fill heat exchangers with water.

K. Charge compression tanks with air.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to heat exchangers to allow service and maintenance. Arrange piping for easy removal of heat exchangers.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace heat exchangers that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers. Refer to Division 1.

END OF SECTION 223500

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SECTION 223910 - LABORATORY SAFETY DEVICE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications and Section 260010, apply to this Section.

B. Section includes: Furnishing and installation of the Laboratory Safety Device System as shown on the Drawings as herein specified.

C. Related Sections:

1. Basic Mechanical Requirements – Section 230500
2. General Requirements for Electrical Work - Section 260010
3. Low Voltage Raceway Distribution - Section 260525
4. Service and Distribution - Section 262400
5. Any requirements for additional systems indicated by the plans and specifications.

1.2 CODES AND REGULATIONS

A. This Section is regulated by the following:

1. NFPA 70, National Electrical Code
2. NFPA 72, National Fire Alarm Code
3. NFPA 90A, Installation of Air Conditioning and Ventilation Systems
4. Americans with Disabilities Act
5. Uniform Building Codes (UBC).
6. Local and State Building Codes
7. All requirements of the local authority having jurisdiction

1.3 WARRANTY

A. Provide a 1-year minimum warranty from date of acceptance of project.

1.4 MANUFACTURER

A. ISIMET - Naples, TX - (903) 897-0737

1.5 SUBMITTALS

A. Submittal procedures: See Section 260010

B. Submit complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval.

C. Product Data shall include the following:

1. Manufacturer
2. Model Number
3. Indicate all options and accessories
4. Catalog data sheet with photographs

1.6 SCOPE OF WORK

A. Plumbing:

1. It shall be the responsibility of the Plumbing Contractor to provide in his base bid all equipment, devices, and other provisions for the Laboratory Safety Device System as outlined in the Drawings and Specifications. Each Utility Controller where shown on the Drawings and herein specified shall operate as an independent Control System.

B. Electrical:

1. It shall be the responsibility of the Electrical Contractor to provide in his base bid all conduit systems, standard electrical boxes, operating power, and all low voltage control wiring for the Laboratory Safety Device System as outlined in the Drawings and Specifications. Each Utility Controller where shown on the Drawings and herein specified shall operate as an independent Control System.

PART 2 - PRODUCTS

2.1 GENERAL

A. All Products and Devices for a complete Laboratory Safety Device System shall be provided as shown on Drawings and as listed in the Equipment Schedule of the Section.

2.2 LA - SERIES CONTROL PANEL

A. As shown on Drawings, provide an ISIMET - LA Series Control Panel. Panel shall be brushed stainless steel with concealed wall box provided with panel service switch, low voltage transformer and fuse block. Wall box shall be NEMA 1 rated.

B. Panel shall have integral printed circuit board with logic device to provide 120-vac output circuits to activate utilities as shown on drawings. Number of output circuits as noted on drawings. Activation of output circuits shall be enabled only by switch ON and then keying.

C. The Panel shall be equipped with a service switch for each output circuit and a momentary enabling key switch. Deactivation of output circuits shall not require engagement of enabling key. Panel shall be provided with N/O momentary panic button assembly to deactivate output circuits in case of emergency. Reset after panic shall occur by re-keying.

D. Provide panel with additional terminals for integration of ISIMET Remote Panic Button Assembly, and opto-isolated input terminal for integration with facility's alarm system. A fire alarm signal shall deactivate all utilities controlled by the LA Series Control Panel.

E. Provide panel with dry contact terminals for output integration. ISIMET "Panic" shall provide a notification signal to a secondary alarm monitoring system. Reset of Controller shall withdraw notification signal.

2.3 SOLENOIDS

A. Furnish Series 300 for all natural gas systems. Solenoid coil shall be 120-vac. Provide a ball valve up-stream from solenoid and wye strainer on all fluid delivery systems. Thoroughly flush piping system prior to placing into service. Final connection to coil from Control Panel by electrical contractor. Solenoids shall close upon loss of operating power and require re-keying for reactivation of service. Solenoid sized as shown on drawings.

2.4 REMOTE PANIC ASSEMBLY

A. Where shown on Drawings provide a wall mounted Remote Panic Assembly. Assembly shall be located as shown on Drawings. Integrate Assembly with Controller.

PART 3 - INTEGRATION AND CONFIGURATION

3.1 BUILDING ALARM SYSTEM

A. Where shown on Drawings, provide low voltage integration wiring from each Utility Controller to connection point of Building Alarm System. Configure Controller to comply with Alarm System monitoring requirements. From Building Alarm System provide low voltage wiring to receive output signal from that system for shut-down of Controller in case of fire alarm. Final connection by others.

3.2 SYSTEM CONFIGURATION

A. Utility Controllers shall be factory configured to the specified configurations and shall be capable of field adjustments to meet specific project modification requirements. Configurations shall be limited to specific placement of control cabling and jumpers at PC Board without requirement for additional modifications to equipment.

3.3 UTILITIES

A. Each utility service with outlets workstations shall be controlled by output circuit at the Utility Controller. Control of services shall be combined onto one output circuit as indicated on Drawings. Services shall be activated by Controller door panel switches and the engaging of the service-enabling key. Activation of utility services shall be restricted to the Instructor by means of the enabling key switch.

3.4 BUILDING ALARM SYSTEM

A. Where indicated by the Drawings, configure each Utility Controller for 5 VDC alarm to integrate with the Building Alarm System. Building Alarm System shall monitor the Controller for Panic. Controller shall accept fire alarm input signal from Building Alarm system for automatic shut-down. Integration with the Building Alarm System should be configured so that any fan activated by the Panic State will deactivate upon a Fire-Alarm signal from that system.

3.5 PANIC RESET

A. Unless stated elsewhere on Drawings, the Utility Controller shall be configured so that reset of Panic State may occur at service enabling key switch on door panel.

3.6 PANIC BUTTON ASSEMBLIES

A. Each Utility Controller System shall be configured so that pressing the panic button will disable all utilities at all workstations and any integrated demonstration stations. Integrated Monitoring shall become active. Panic shall provide 5 VDC output alarm signal. Remote Panic Assemblies, including Demonstration Station, shall function like door-mounted assembly.

PART 4 - EXECUTION

4.1 INSTALLATION

A. Install in accordance with manufacturer's recommendations and instructions. Verify manufacturer's mounting heights to comply with ADA or other standards.

B. Furnish and install all devices as shown on Drawings and as specified herein. Where device is to be installed by other trades, furnish and then turn over to appropriate trade for installation.

C. Furnish, install and make final connections to monitoring and remote panic assembly panels as indicated on Drawings and specified herein. Furnish and install low voltage control wiring from Utility Controller to connection point of Energy Management Control System and Building Alarm. Final connection by others.

4.2 PLUMBING

A. Plumbing contractor shall furnish all equipment. Install and make final connections to all piping systems where indicated by Drawings and specifications. Provide to Electrical Contractor for installation all devices not requiring connections to utility piping systems. Install in accordance with SECTION 221100 – Domestic Water Piping.

4.3 ELECTRICAL

A. Electrical Contractor shall furnish all conduit and wiring, making final wiring connections to all equipment as indicated by Drawings and specifications. Contractor shall install all devices not requiring connections to utility piping systems. Contractor shall be responsible for all system configurations, integration, test and start-up.

4.4 CONDUIT

A. Unless otherwise specified for wiring systems, provide conduits for control and integration wiring from point of connection to each device to accessible point above ceiling. Provide separate conduit for each device that is controlled and integrated with Controller. Conduits for monitoring panels, arrays and panic assemblies shall be separate from line voltage, control wiring and integrated system wiring. Where system components are mounted along side the Controller within a common wall, install conduct for low voltage control wiring between the devices.

4.5 WIRING

A. Operating Power

1. Provide dedicated electrical service to each Utility Controller. Verify wiring requirements with Manufacturer's requirements. Minimum 15 amp circuit.

B. Low Voltage Control Wiring

1. Provide 24 VAC control wiring from Utility Controller to each controlled utility or device. Make connections at controlled device and terminate at output terminal on Controller's control panel. Minimum wiring, 18 AWG, plenum rated cable. Provide cable with required conductors plus two spares.

C. Integrated Systems

1. Provide low voltage wiring for integration to other systems as shown on Drawings. Verify voltage and wire sizes to comply with requirements of each system.

D. Remote Panic Assembly

1. Provide 5 VDC control wiring from Utility Controller to each Remote Panic Assembly Panel within the classroom. Make connections at panel and terminate at Controller's PC Board. Minimum wiring, 22 AWG, plenum rated cable. Provide cable with required conductors plus two spares. Where Drawings indicate two or more remote panels, connect each panel in parallel.

E. Companioned LA Series Control Panel

1. Where shown on drawings, provide 5 VDC control wiring from Utility Controller to the LA Series Control Panel. Make connections at panel and terminate at Controller's PC Board so that a panic signal from one unit will place the other into its panic mode. Minimum wiring, 22 AWG, plenum rated cable. Provide cable with six conductors. Final wiring connections shall be as recommended by the manufacturer.

PART 5 - SYSTEM TEST AND START-UP

5.1 GENERAL

A. Prior to placing the Utility Controller System into service, perform ALL Start-up procedures and Checklists as stated in Manufacturer's Operations and Maintenance Procedure literature.

B. Verify that all components and control devices comply with manufacturer's requirements and recommendations and that all devices and installations conform to Drawings and Specification requirements.

1. Verify that all controlled piping systems have been thoroughly cleaned.
2. Verify that all controlled devices and circuits are ON.
3. Verify that connections to all integrated systems are complete.
4. Verify that all monitoring systems respond to Panic.
5. Verify that remote panic assemblies activate the Panic State.

C. Upon completion of ALL Start-up tests, place the system into service. Complete all warranty registration documents. Submit originals with other project related closeout and O & M documentation. Review all operating procedures with a representative of the Owner. Provide all System keys to the Owner's representative.

END OF SECTION 223910

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SECTION 224000 - PLUMBING EQUIPMENT & FIXTURES

PART 1 - GENERAL

1.1 INTENT

A. It is the intent that this Section shall be used in conjunction with the PLUMBING TRADE and BASIC MATERIALS Sections of Division 15, to establish requirements for the Work. These Sections include but are not limited to:

1. Section 230501, Basic Materials & Methods - Mechanical
2. Section 230548, Basic Materials - Seismic Restraint & Vibration Isolation for Mechanical
3. Section 230719, Basic Materials - Mechanical Insulation
4. Section 230593, Basic Materials - Testing, Adjusting, and Balancing (Separately Contracted By Owner)
5. Section 220000, Plumbing Trade Work

B. THIS PROJECT WILL BE COMMISSIONED. REFER TO COMMISSIONING SPECIFICATIONS SECTION 18000 FOR INFORMATION AND RESPONSIBILITIES. THE COMMISSIONING PROCESS WILL REQUIRE ADDITIONAL LABOR, MATERIAL AND/OR OTHER COSTS WHICH MUST BE PROVIDED BY THE MECHANICAL CONTRACTOR AS PART OF THIS PROJECT.

1.2 SPECIAL SUBMITTALS

A. Refer to DIVISION 1 and to PLUMBING TRADE and BASIC MATERIALS Sections of Division 22, for requirements on general submittals, such as shop drawings and warranties.

PART 2 - PRODUCTS

2.1 FIXTURES - GENERAL

A. Water closets, urinals and lavatories shall be of same manufacture, by Crane, American-Standard, Kohler, or Elijer. Flush valves shall be by Sloan or Zurn. Stainless steel sinks shall be by Elkay, Just or Moen. Service receptors and other special items shall be by acceptable manufacturer.

B. Provide trim, stops, trap and flush valve for each fixture. Exposed trim, fittings, traps, etc. shall be chrome plated. Provide escutcheons when not included with fixture trim.

2.2 WATER CLOSET

A. WC-1 (MENS) Wall Mounted, Flush Valve: Siphon jet action, 1 1/2 inch top spud, vitreous china, 1.6 gallon water saving flush valve with elongated, open front seat. Refer to architectural specifications for mounting height. Sloan Royal flush valve #111-ES-S hard wired, sensor operated flush valve for new installations.

1. Zurn #5610
2. Or Approved Equal

B. WC-2 (WOMENS) Wall Mounted, Flush Valve: Siphon jet action, 1 1/2 inch top spud, vitreous china, Dual-Flush 1.1 or 1.6 gallon water saving Sloan Ecos #8111-1.6/1.1 battery powered electronic dual flush valve with elongated, open front seat. Refer to architectural specifications for mounting height.

1. Zurn #5610
2. Or Approved Equal

C. WC-3 (MENS) Wall Mounted, Barrier-Free Height, Flush Valve: Siphon jet action, 1 1/2 inch top spud, vitreous china, 1.6 gallon water saving flush valve with elongated, open front seat. Refer to architectural specifications for mounting height. Sloan Royal flush valve #111-ES-S hard wired, sensor operated flush valve for new installations. Refer to architectural specifications for mounting height.

1. Zurn #5610
2. Or Approved Equal

D. WC-4 (WOMENS) Wall Mounted, Barrier-Free Height, Flush Valve: Siphon jet action, 1 1/2 inch top spud, vitreous china, Dual-Flush 1.1 or 1.6 gallon water saving Sloan Ecos #8111-1.6/1.1 battery powered electronic dual flush valve with elongated, open front seat. Refer to architectural specifications for mounting height.

1. Zurn #5610
2. Or Approved Equal

2.3 UR-1: URINAL

A. Wall hung 3/4" top inlet spud, vitreous china, washout urinal, low consumption water saver flush valve, concealed chair carrier, mount top of rim 24" above floor. Hard-Wired sensor operated flush valve.

1. Zurn model #Z5738 "The Small Pint"

   a. Zurn #ZEG6003EV-HW6 high efficiency flushometer valve.

2. Or Equal

2.4 LAVATORY

A. L-1: Undercounter mount, Vitreous china, 21" x 17" oval, 4" centers, front overflow with faucet, supplies, adjustable "P" trap, offset drain, and ADA compliant drain cover by Truebro, Plumberex, or approved equal.

1. Crane model #1981 "Tiara"
2. Eljer model #051-3390 "Barrow"
3. American Standard model #0497.221 "Ovalyn"

Faucet: Sensor operated, ADA compliant faucet, chrome finish, 24 VAC, hard wired, 0.5 gpm vandal resistant aerator. Sloan model #ETF-600

B. L-2: Wall Mount: Vitreous china, 20" x 27", 4" centers, vitreous china lavatory with contoured front, shallow front basin, front overflow, drilled for carrier with concealed arms. Furnish with faucet and, supplies, adjustable "P" trap, offset drain, and ADA compliant drain cover by Truebro, Plumberex, or approved equal.

1. Crane model #1H360V "Wheelchair"
2. Eljer model #051-2964 "Wheelchair"
3. American Standard model #9141.011 "Wheelchair Users Lavatory"

Faucet: Sensor operated, ADA compliant faucet, chrome finish, 24 VAC, hard wired, 0.5 gpm vandal resistant aerator. Sloan model #ETF-600

2.5 MOP SERVICE BASIN

A. MS-1 (Mop Service Basin) Floor mount, terrazo, 36" x 24" x 12 high, drop front with stainless steel cap, white color, with drain body complete with service faucet, Chicago #897 with vacuum breaker, hose, hose bracket, wall bracket.

1. Florestone model #91
2. Stern Williams model #HL2100
3. Fiat model #3624

B. MS-2 (Mop Service Basin) Floor mount, corner type, terrazo, 24" x 24" x 12 high, drop front with stainless steel cap, white color, with drain body complete with service faucet, Chicago #897 with vacuum breaker, hose, hose bracket, wall bracket.

1. Florestone model #95
2. Stern Williams model #SBC-1700
3. Fiat model #TSBC1610

C. MS-3 (Utility Sink) Floor mount, freestanding type, molded plastic, 20" x 24" x 34-7/8" high, with 4 legs, white color, resistant to fading and abrasion, drain body and complete with faucet Chicago #1100-317CP, 8" deck mount faucet with wrist blade handles.

1. Florestone model #20-FM
2. Fiat model #FL1
3. Swanstone model #MF-1F

2.6 SINKS

A. KS-1 (Kitchen Sink) Counter Top, Single Bowl: ADA Compliant, 18 gauge, type 304 stainless steel, punched for faucet on 8" centers, self rimming, undercoated, nominal 25" x 22" x 6-1/2" deep compartment, faucet with aerator, lever handles, and basket strainer. Refer to architectural drawings for mounting height.

1. Elkay model #LRAD2522 "Lustertone"
2. Just model #SL-ADA-2125-A-GR "Stylist"

Faucet: ADA compliant, wrist blade handles, chrome finish, washerless, cartridge type flow elements, 8" long swing spout, 1/2" threaded male inlet shanks, and 2.2 gpm flow aerator.

B. S-3 (Vivarium Sink) Wall Mounted, Single Bowl: ADA Compliant, 18 gauge, type 304 stainless steel hand wash-up sink. Back punched for faucet on 8" centers, brushed finish, full length 7" high backsplash. Nominal 12" x 9-1/4" x 6" deep compartment. Furnish with wall hanger and integral steel support brackets. Refer to architectural drawings for mounting height. Furnish with faucet and, supplies, adjustable "P" trap, offset drain, and ADA compliant drain cover by Truebro, Plumberex, or approved equal.

Faucet: ADA compliant, 4" wrist blade handles, chrome finish, cartridge type flow elements, 5-3/8" Reach gooseneck spout, 1/2" threaded male inlet shanks, and .5 gpm flow aerator. Chicago #540LD-GN28-317-E2805-5.

1. Elkay model #CHS1716 hand Wash-Up Sink
2. Or Approved Equal

2.7 FIXTURE SUPPORTS

A. Concealed arm supports for urinals shall have steel top and bottom plates with bolts to support fixture independently from the wall; adjustable sleeves, steel tubular uprights and alignment trusses, steel plates with adjustable holes, bolts, nuts, and chrome plated cap nuts and washers. Top supporting plates shall have cutouts when used with back inlet urinals.

2.8 FOR LABORATORY SINKS AND FUME HOODS SPECIFIED UNDER ARCHITECTURAL DIVISION:

A. Provide acid-proof polypropylene tailpieces and traps; universal traps are NOT acceptable. Provide piping and final connections. Install traps and piping in piping plenums below service strips. Laboratory counters, sinks, fume hoods and drain bodies shall be furnished and set in place under **DIVISION 11**, EQUIPMENT.

2.9 WATER COOLERS AND DRINKING FOUNTAINS

A. DF-1 (Drinking Fountain) Two station, Barrier-free, shall have compressors, insulated tank, point of use filter, piping and heat exchanger, stainless steel bowl, and cabinet. Self-Closing controls to be provided on front, left, and right sides. Water piping shall be copper. Coolers unit shall be air-cooled with hermetically sealed compressors. Refrigerant piping shall be copper. Tank, piping and heat exchanger shall be insulated. Compressor motor shall be 120-volt, single phase, 60 Hz. Provide cold water supply connection with shut-off valve, and waste connection with P-trap and accessible cleanout. Unit shall be rated at minimum capacity indicated, from 80°F to 50°F, at room temperature of 90°F.

1. Elkay model #EZSTL8C
2. Oasis model #PRF8ACSL
3. Haws model #HWUACO8LSS

2.10 WASHDOWN STATION

A. Washdown Stations shall be by Strahman.

B. Type WS-1, Washdown Station: Wall mounted, all stainless steel construction, for hot and cold water. Equipped with dial-type gauge to accurately indicate the wash water's temperature. Furnish with stainless steel hose rack, high pressure water hose. Automatic, water saver spray nozzle, and integral check valves. Strahman #M-159TM.

2.11 HOT WATER CIRCULATOR AND CONTROLS

A. Provide in-line circulating pump in recirculating line adjacent to Lab, TW & Domestic hot water heaters. Pump shall be close coupled, all bronze pump with mechanical seal, Taco or acceptable equivalent:

1. Grundfos

B. Pump shall be actuated by BMS (Building Mgmt. System).

2.12 VACUUM RELIEF VALVE

A. Provide vacuum relief valve:

1. On cold water entrance pipe to water heater, when heater is located above and down-feeds to fixtures
2. For pressure tanks on booster pump systems.

B. Valve shall be Watts #36A, bronze body.

2.13 DUPLEX LABORATORY VACUUM SYSTEM

A. Duplex rotary vane tank mounted vacuum system, equal to Powerex model IVD-040, 5 hp (2ea) motors, 460/3/60, rated at 17.0 scfm (ea) @ 19" hg, mounted on 120 gal epoxy internally lined vacuum receiver, includes component isolation, duplex control panel, furnished with the following: fusible disconnects, magnetic starters, alternator, on/off switches, power on light, control transformer, terminal strip for low vacuum alarm, w/ Solberg heavy duty vacuum mist eliminator mounted on each exhaust, system start up and maintenance training.

2.14 AIR COMPRESSOR AND DRYER PACKAGE

A. Single stage oilless rotary scroll duplex tank mounted air compressor system equal to Powerex model STD-0503, includes (2ea) 5 hp scroll compressors (10 hp total), rated at 30 scfm (total) @ 100 psig, mounted on a 120 gal ASME/NB coded epoxy lined receiver, aftercooler with moisture separator and trap, tank drain, component isolation, NEMA 1 dual power source control panel to provide power for complete system including all compressors, dryer, drains, and alarms, panel complete with disconnects, starters, hour meters, high temp shut down, visual and audible alarms, terminal strip for low pressure alarm, a single heatless desiccant air dryer equal to Domnick Hunter model DME-015, to match the capacity of both compressor units, utilizing a dew point dependant purge saving device, with .01 micron pre-filter, and 1 micron after-filter, dryer to deliver a – 40 degree f dew point, all components mounted and plumbed on

the top plate of the tank, for single point electrical and plumbing, system start up and maintenance training included.

2.15 HIGH PURITY RODI WATER SUPPLY SYSTEM

A. All equipment listed in this specification shall be provided by Hydro Service & Supplies, Inc. or approved equal. The equipment supplier must be able to install and provide service on all quoted equipment and service must be available within 24 hours.

B. The central ultrapure water system shall consist of three major sections: pretreatment equipment, primary treatment equipment, and post treatment equipment. The central ultrapure water system shall produce 1000 gallons per 8 hours at 50°F of ASTM Type III Reagent Grade water. The distribution shall be fully recirculated.

C. The pretreatment equipment shall be designed to remove contaminants that can affect the operation of the primary treatment equipment (reverse osmosis unit). The pretreatment equipment shall be designed to remove particulates, suspended solids, organics and colloids that could prematurely foul the reverse osmosis membranes. The pretreatment equipment shall include the following components:

1. Multimedia Turbidity Filter
2. Carbon Filter
3. Water Softener
4. Five (5) Micron Prefilter

D. The primary treatment equipment shall be designed to remove an average of 97% of the total dissolved solids from the feed water source. In addition, the primary treatment system shall remove most remaining colloidal particles and shall remove macromolecules larger than 200 molecular weight. The primary treatment equipment shall consist of the following:

1. Reverse Osmosis Unit

E. The post treatment equipment shall be designed to produce Purified Water. The distribution pumps shall be designed to continuously recirculate water through the post treatment equipment and to the point-of-use outlets. The post treatment equipment shall include the following:

1. Storage Tank
2. Distribution Pump
3. Ultraviolet Sterilizer
4. Post Filter

F. Instrumentation and controls shall be shown on the drawing (water system detail) and as described in Part 1.10.

G. The central ultrapure water system shall be installed complete with interconnecting piping and interconnecting electrical work.

H. The equipment supplier shall provide two (2) operation and maintenance manuals.

I. The equipment supplier shall provide two (2) complete sets of project drawings including process and instrumentation drawing, equipment layout drawing, electrical plan drawing, and wiring diagrams. All drawings should be done using AutoCAD R14 or later versions.

J. The equipment supplier shall provide equipment, valve, and instrumentation tags.

K. All pipe, valves, and fittings shall be manufactured of pressure rated polypropylene with heat fusion, socket type joints with an interference fit. Ultraviolet inhibitors shall be used in the pipe to prevent UV destruction of the piping system. The piping system shall be equal to the BETA PP system manufactured by +GF+ Plastic Systems, Inc. as provided by Hydro Service & Supplies, Inc. or approved equal.

L. The equipment supplier shall provide personnel with at least five (5) years of related experience for the installation of the water system.

2.16 MULTIMEDIA TURBIDITY FILTER

A. The purpose of the multi-media turbidity filter is to remove turbidity from water. The multi-media filter shall contain three layers of media specially selected to provide decreasing porosity as the water flows downward through the bed. The filter shall be designed to remove particles to about 10-micron particle size. The media shall be specially selected for particle size and density to permit proper restratification after the filter is backwashed.

B. The operating limits of the filter shall be 25 to 120 psi at 35° to 100° F.

C. The pressure vessel shall be made of high-pressure fiberglass (12" diameter x 52" high) and designed for a working pressure of 120 psi. The tank shall have an ABS or polyethylene liner and be UL listed. The tank lining shall meet the requirements of the FDA.

D. The filtered water collector and backwash water distributor shall be fine-slotted ABS or CPVC plastic manifolds with slots no larger than 0.009-inch width. The lower distributors shall be covered with a minimum of two inches of quartz underbedding to equalize flow through the media.

E. The top mounted control valve shall be a five cycle, brass valve for positive control of all service, backwash, and rinse cycles. The valve shall include all fixed and self-adjusting flow regulators to control the rate of flow during backwash and rinse cycles. The valve shall be designed in such a way that most service can be performed without disconnecting the inlet and outlet plumbing connections.

F. The main control valve is operated by a 7-day mechanical time clock control capable of backwashing the filter at a pre-set time. The control shall operate on 110 volts. The control shall include a manual override to permit manual initiation of backwashing. The control shall have provision for individual adjustment of backwash and rinse times. The control valve shall include a switch to signal the reverse osmosis unit when the backwash cycle begins.

G. Provide interconnecting Beta PP plumbing as manufactured by +GF+ and installed by Hydro Service & Supplies, Inc.

2.17 CARBON FILTER

A. The purpose of the activated carbon filter is to remove chlorine and some organics from the water. The media is a high capacity black granular carbon with rugged grain structure, high density and large surface area for efficient removal of chlorine as well as other taste, odor and color-causing organics. It works well over a wide pH range. The media shall contain a special catalytic agent to aid in chloramine removal.

B. The carbon filter shall contain 3 ft3 of carbon.

C. The operating limits of the filter shall be 25 to 120 psi at 35° to 100° F.

D. The pressure vessel shall be made of high-pressure fiberglass, designed for a working pressure of 120 psi. The tank shall have an ABS or polyethylene liner and be UL listed. The tank lining shall meet the requirements of the FDA.

E. The filtered water collector and backwash water distributor shall be fine-slotted ABS or CPVC plastic manifolds with slots no larger than 0.009-inch width. The lower distributors shall be covered with a minimum of two inches of quartz underbedding to equalize flow through the media.

F. The top mounted control valve shall be a five cycle, brass valve for positive control of all service, backwash, and rinse cycles. The valve shall include all fixed and self-adjusting flow regulators to control the rate of flow during backwash and rinse cycles. The valve shall be designed in such a way that most service can be performed without disconnecting the inlet and outlet plumbing connections.

G. The main control valve is operated by a 7-day mechanical time clock control capable of backwashing the filter at a pre-set time. The control shall operate on 110 volts. The control shall include a manual override to permit manual initiation of backwashing. The control shall have provision for individual adjustment of backwash and rinse times. The control valve shall include a switch to signal the central control panel when the backwash cycle begins.

H. Provide interconnecting Beta PP plumbing as manufactured by +GF+ and installed by Hydro Service & Supplies, Inc.

2.18 WATER SOFTENER

A. The purpose of the water softener is to remove mineral hardness from water. An ion exchange process utilizing a high capacity cation exchange resin in the sodium exchange mode shall accomplish softening. Automatic regeneration shall be accomplished using a salt (brine) solution.

B. The high capacity synthetic cation exchange resin shall have a minimum exchange capacity of 20,000 grains when regenerated with 5 pounds of salt per cubic foot of media. The resin shall be solid with uniform particle size, clean and free of dirt and extraneous matter.

C. The operating limits of the softener shall be 25 to 120 psi at 35° to 100° F. The tank dimensions shall be 9" diameter by 48" high. Media volume shall be 1 cubic feet.

D. The pressure vessel shall be made of high-pressure fiberglass, designed for a working pressure of 120 psi. The tank shall have an ABS or polyethylene liner and be UL listed. The tank lining shall meet FDA requirements.

E. The water collector and backwash water distributor shall be a fine-slotted ABS or CPVC plastic manifold with slots no larger than 0.009-inch width. The lower distributors shall be covered with a minimum of two inches of quartz underbedding to equalize flow through the media.

F. The top mounted control valve shall be a five cycle, brass valve for positive control of all service, backwash, brine, and rinse cycles. The valve shall include all fixed and self-adjusting flow regulators to control the rate of flow during backwash, brine, and rinse cycles. The valve shall be designed in such a way that most service can be performed without disconnecting the inlet and outlet plumbing connections.

G. The main control valve is operated by a 7-day mechanical time clock control capable of regenerating the softener at a pre-set time. The control shall operate on 110 volts. The control shall include a manual override to permit manual initiation of regeneration. The control shall have provision for individual adjustment of backwash, brine, brine refill, and rinse times. The control valve shall include a switch to signal the reverse osmosis unit when the regeneration cycle begins.

H. A combination salt storage tank, with cover, and brine well shall be supplied as part of the system. The brine tank shall be large enough to hold salt for at least ten regenerations between refills. The brine tank shall be made of polyethylene or FRP. Provide interconnecting Beta PP plumbing as manufactured by +GF+ and installed by Hydro Service & Supplies, Inc.

2.19 FIVE-MICRON PREFILTER

A. The cartridge filter system shall be designed to remove particles larger than 5 microns from the water. Nominal rated prefiltration is required to protect the reverse osmosis membranes from particulate fouling.

B. The filter housing shall be reinforced polypropylene construction. The housing shall consist of two parts, filter bowl and head. Fixed guides within the filter housing shall allow easy loading, unloading and proper alignment and seating of the filter cartridge. The filter housing shall be designed to accommodate nominally rated filter cartridges with a knife-edge seal. An O-ring shall be provided to seal the two-part housing. Filter housing shall be provided with a universal mounting bracket if indicated. Housings for 2 5/8" diameter filters shall be designed for operation at 90 psi and 100° F.

C. Provide one 20" long polypropylene filter housing to house one 20" long x 2 5/8" diameter x 5 micron filter cartridge.

D. Provide interconnecting Beta PP plumbing as manufactured by +GF+ and installed by Hydro Service & Supplies, Inc.

2.20 REVERSE OSMOSIS UNIT

A. Reverse osmosis is a membrane process in which feed water is maintained under high pressure against a semipermeable membrane reversing natural osmotic pressure and allowing water

molecules to permeate through the membrane. Dissolved solids, organics, and colloids are concentrated on the feed water side of the membrane. The process results in two products: a concentrated brine solution, which is discharged to drain and a high quality permeate water.

B. The reverse osmosis unit shall be designed to produce 2,920-gpd at 77°F feed water temperature

C. The reverse osmosis system shall be a completely self-contained water treatment system, pre-wired and preplumbed. The system shall consist of a polyurethane coated heavy-duty aluminum cabinet, FRP or stainless steel pressure vessels with membrane modules, high-pressure pump, piping, valves, and instrumentation and controls. D. Reverse osmosis membrane modules shall be spiral wound thin-film composite type.

D. The high-pressure pump shall be a rotary vane, positive displacement type. The pump shall be of brass construction with internal graphite bearings and vanes. An external ball bearing shall be provided outside the liquid chamber and shall be pre-lubricated for the life of the pump. A mechanical seal shall be provided to seal the rotor shaft. The pump shall be close coupled to a fractional horsepower motor, 120 volts. F. Standard features of the system shall include a feed water solenoid valve for automatic operation, low pressure cut-out switch, membrane pressure gauge, high pressure nylon tubing, back-pressure control valve, concentrate pressure gauge and flow gauge, permeate flow gauge, timer controlled automatic flush system, and a dual channel resistivity monitor with feed water and permeate water resistivity sensors.

E. The reverse osmosis unit shall be U.L. Listed. The reverse osmosis unit shall be manufactured by Hydro Service & Supplies, Inc.

2.21 STORAGE TANK

A. The storage tank shall be 600 gallons capacity. The tank shall be centrifugally cast using premium grade epoxy resin and chopped glass fibers in a ratio of resin to glass fiber of about 75 to 25. The inside surface shall be coated with 10 mils of resin to provide a smooth, corrosion resistant finish. The premium grade resin shall meet the requirements of the FDA for food handling applications. The FRP tank shall be a vertical design with dome top, dish bottom, and an FRP support skirt.

B. The storage tank shall be provided with a high level control to operate the RO unit and a low water level control to shut-down the distribution pump. Each level control shall contain two float switches. The two switches are to create a "differential". The differential protects the RO pump motor or the distribution pump motor from cycling on and off at a very frequent rate. The high level differential shall be a minimum of 6" and the low level differential shall be a minimum of 2". The electrical components are mounted in an aluminum enclosure which is mounted on top of the storage tank. The level controls are connected to the RO and distribution pump by Type SJ (14/4) power cord or are hard-wired with conduit.

C. The tank shall also include a 0.2 micron hydrophobic vent filter designed for maximum pump drawdown flow rate, sealed fillwell, drain connection, and a protected overflow designed to prevent contaminants from entering the tank.

D. The storage tank shall include necessary bulkhead fittings, cover, EPDM gasket and fillwell.

E. The storage tank shall be manufactured by Design Tanks as provided by Hydro Service & Supplies, Inc.

F. Provide interconnecting Beta PP plumbing as manufactured by +GF+ and installed by Hydro Service & Supplies, Inc.

2.22 DISTRIBUTION PUMP

A. The distribution pump shall be designed to recirculate purified water through the distribution loop. The pump discharge flow rate and pressure shall be 25 gpm and 170 ft, respectively. Each pump shall be 2HP 460/60/3.

B. Pump type shall be multi-stage centrifugal that is designed for heavy duty, continuous service.

C. The pump end shall be of the vertical multi-stage design with the motor mounted directly to the top of the pump.

D. The pump suction/discharge chamber, impellers, pump shaft, diffuser chambers, outer discharge sleeve, and impeller seal ring retainers shall be constructed of 316 stainless steel.

E. The mechanical seal assembly shall be tungsten carbide / carbon or tungsten carbide / tungsten carbide.

F. Pump connections shall be Victaulic type.

G. Provide pump with one combination starter / disconnect switch with indicator light and transformer.

H. Provide interconnecting Beta PP plumbing as manufactured by +GF+ and installed by Hydro Service & Supplies, Inc.

2.23 ULTRAVIOLET STERILIZER

A. The ultraviolet sterilizer shall be capable of destroying greater than 99 percent of the microorganisms in water with 254-nanometer ultraviolet radiation. The ultraviolet sterilizer shall be designed for 30-gpm flowrate.

B. The ultraviolet sterilizer shall consist of an electropolished and passivated 316L stainless steel chamber with a clear fused quartz jacket, ultraviolet lamp, and electrical ballast with power cordset

C. The high intensity ultraviolet lamp shall provide greater than 30,000-microwatt seconds per square centimeter of 254 nm ultraviolet radiation.

D. The ultraviolet unit shall be a vertical design with support to mount to floor.

E. Provide interconnecting Beta PP plumbing as manufactured by +GF+ and installed by Hydro Service & Supplies, Inc.

2.24 POST FILTER

A. The cartridge filter system shall be designed to remove particles larger than 0.2 micron. Absolute final filtration is required to remove all viable and non-viable particulate matter from the process stream. The filter cartridge shall be manufactured of pleated polypropylene or asymmetric polysulfone. Materials of construction shall meet FDA requirements for use in food handling applications. The filter cartridges shall be designed with O-ring seals. The design flow rate shall not exceed 3 gpm per 10-inch equivalent filter length for 2 5/8" diameter filters. Provide five (5) 20" X 0.2 micron 2 5/8" diameter filter cartridges.

B. The filter housing shall have all wetted surfaces made from 304 stainless steel. Each housing shall be individually inspected using state of the art surface measuring equipment. Each housing shall be 100% hydrostatically tested to ensure the housing integrity. The housing shall include stainless steel hold down rods and plate to ensure proper alignment and positive sealing. The housing bell and base are connected using a heavy duty V band clamp. The filter housing shall be designed for operation at 150 psi and 200oF. Provide one (1) multi-element style housing designed to hold five (5) 20" long filters in each housing.

C. Provide interconnecting Beta PP plumbing as manufactured by +GF+ and installed by Hydro Service & Supplies, Inc

2.25 INSTRUMENTATION

A. Provide instrumentation as per drawing P4.1.

2.26 REGULATORS AND MANIFOLDS

A. Gas Line Check Valves: Model #U3FBRVT3.50SS: In line style check valve prevents flow in reverse direction. Brass body, Viton seat, 3.5 PSIG Cracking Pressure, 3/4" FNPT thread ends. Manufacturer: Check all valve company or approved equal.

B. Bottle Gas Change-Over Regulator Panels, CO_2 Service: Model #CS 2210-241-035: Provides for uninterrupted gas flow and line pressure regulation and shut off valve to laboratory equipment. Rated to 3500 PSIG Max inlet pressure, Brass construction, 316 SS Diaphragm & Wetted Parts, 1/4" FNPT inlet, outlet and gauge port connections. Assembly includes three (3) gauges two (2) pigtail assemblies constructed of 36" Teflon Lined SST Braided hose with CGA connectors and shut-off valves. One (1) wall-mounting bracket. Manufacturer: Tescom Corporation or approved equal.

C. Laboratory Point of Use Filter-Regulators, Compressed Dry Air Service: Model #300-BA: Provides pressure regulation to point of use location for laboratory clean dry air. Rated to 250 PSIG max inlet pressure, Die-cast aluminum alloy body, 1/4" PSIG Inlet & Outlet Port Connections 250 PSIG max inlet pressure 0-30 PSIG outlet pressure range, 40 Micron Nom Inlet Filter. Assembly includes: pressure gauges, mounting bracket P/N 446-707-028 included. Manufacturer: Control Air or approved equal.

PART 3 - EXECUTION

3.1 FIXTURE INSTALLATION

A. Fixture supports shall be anchored to slab with threaded rod and nuts. Inserts and expansion shields are NOT acceptable. Support feet for fixture carriers shall be entirely within pipe chase.

B. Mounting height of handicapped fixtures shall be as required by Code; mounting height of other fixtures and fixture locations shall be as shown on Architectural Contract Drawings. Refer discrepancies to Architect for resolution.

C. Flush valve handles for handicapped urinals and handicapped water closets shall be facing wide side of fixtures where wheelchair access occurs.

END OF SECTION 224000

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SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following emergency plumbing fixtures:

1. Emergency showers.
2. Combination units.
3. Water-tempering equipment.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Tepid: Moderately warm. Approximately 85°F temperature or as identified on Drawings.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 EMERGENCY FIXTURES

A. Type SS-1 – Recessed Emergency Shower: Provide Guardian model #GBF1670 barrier-free design with stainless steel shower head; meeting ANSI #Z358-1, latest Edition. Provide Guardian model #G3800 thermostatic mixing valve with integral cold water bypass.

2.2 SOURCE QUALITY CONTROL

A. Certify performance of plumbed emergency plumbing fixtures by independent testing agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water supply piping to fixtures. Use ball valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted or required. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 15 Section "Valves."

1. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 15 Section "Basic Mechanical Materials and Methods."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 15 Section "Meters and Gages."

G. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.

H. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 15 Section "Sanitary Waste and Vent Piping."

I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 23 Section "Basic Mechanical Materials and Methods."

J. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 23 Section "Mechanical Identification."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.

C. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.

D. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary drainage piping.

3.4 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

C. Report test results in writing.

3.5 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500

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SECTION 226600 - LABORATORY WASTE AND VENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping and specialties for the following systems:

1. Chemical-waste and vent, gravity-flow, nonpressure piping system designated "chemical waste."

1.3 DEFINITIONS

A. CPVC: Chlorinated polyvinyl chloride plastic.

B. CR: Chlorosulfonated polyethylene synthetic rubber.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FPM: Vinylidene fluoride-hexafluoro propylene copolymer rubber.

E. HDPE: High-density polyethylene plastic.

F. PE: Polyethylene plastic.

G. PP: Polypropylene plastic.

H. PTFE: Polytetrafluoroethylene plastic.

I. PVC: Polyvinyl chloride plastic.

J. PVDF: Polyvinylidene fluoride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Rating: 10-foot head of water.

1.5 SUBMITTALS

A. Product Data: For chemical-waste piping materials, components, and specialties and for neutralization systems.

B. Coordination Drawings: For piping and specialties, including relation to other services that serve same work areas.

C. Maintenance Data: For neutralization systems and tanks to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain pipe, fittings, and joining materials for each piping system through one source from a single manufacturer.

1. Exception: Piping from different manufacturers may be used in same system if indicated and suitable transition fittings matching both piping materials are used.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of chemical-waste specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Piping materials shall bear label, stamp, or other markings of specified testing laboratory.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with ASME B31.3, "Process Piping."

F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties with sealing plugs in ends or with end protection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPES, TUBES, AND FITTINGS

A. PP Drainage Pipe and Fittings: ASTM F 1412, pipe extruded and drainage-pattern fittings molded, with Schedule 40 dimensions, from PP resin with fire-retardant additive complying with ASTM D 4101. Include fusion and mechanical joint ends.

B. PVDF Drainage Pipe and Fittings: Pipe extruded and fittings molded, with Schedule 40 dimensions, from PVDF resin complying with ASTM D 3222. Include drainage-pattern fittings complying with ASTM D 3311, except with fusion- and mechanical joint ends.

C. CPVC Pipe: ASTM F 441/F 441M, Schedule 40. Include drainage-pattern fittings complying with ASTM D 3311

1. CPVC Socket Fittings: ASTM D 3311, Schedule 40.

2.4 JOINING MATERIALS

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

B. Couplings: Assemblies with combination of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

C. Adapters and Transition Fittings: Assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

D. Flanges: Assemblies of companion flanges gasket complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

2.5 SPECIALTIES

A. Corrosion-Resistant Traps: P-trap or drum trap; NPS 1-1/2 or NPS 2, as required to match connected piping.

1. PP: ASTM D 4101, PP resin, with mechanical-joint pipe connections.
2. PVDF: ASTM D 3222, PVDF resin, with mechanical-joint pipe connections.
3. CPVC: ASTM D 3311, CPVC, with solvent-weld joint pipe connections.

B. Sampling Tank: The five gallon sampling tank shall be constructed of high density polyethylene (HDPE). Tank shall be 11 inch diameter by 161/2 inch high with a bolted and

gasketed cover. Nuts and bolts shall be stainless steel. The cover shall have a threaded female fitting to accept a pH probe. Sampling tank shall have an inlet and an outlet. The inlet and outlet fitting shall be iron pipe size thread to accept process piping up to six inch in size.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Above Floor Chemical-Waste Piping: Use any of the following piping materials for each size range:

1. NPS 1-1/2 to NPS 4: PP drainage piping and electrofusion joints.
2. NPS 1-1/2 to NPS 4: CPVC drainage piping and solvent-cemented joints NPS 1-1/2 to NPS 4: PVDF drainage piping and electrofusion joints.
3. NPS 6: PP drainage piping and electrofusion joints.
4. NPS 6: CPVC drainage piping and solvent-cemented joints.
5. NPS 6: PVDF drainage piping and electrofusion joints.

D. Under Slabs-on-Grade, Chemical-Waste Piping: Use any of the following piping materials for each size range:

1. NPS 1-1/2 to NPS 4: PP drainage piping and electrofusion joints.
2. NPS 1-1/2 to NPS 4: CPVC drainage piping and solvent-cemented joints.
3. NPS 1-1/2 to NPS 4: PVDF drainage piping and electrofusion joints.
4. NPS 6: PP drainage piping and electrofusion joints.
5. NPS 6: CPVC drainage piping and solvent-cemented joints.
6. NPS 6: PVDF drainage piping and electrofusion joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. If specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball, butterfly, or gate valves.
2. Throttling Duty: Use ball, butterfly, or globe valves.

B. Use plastic and plastic-lined valves with wetted surfaces made of same material as or compatible with piping and compatible with system liquid.

C. PIPING INSTALLATION

D. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.

E. Install piping next to equipment, accessories, and specialties to allow service and maintenance.

F. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction. If specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Plastic-Piping, Heat-Fusion Joints: Make polyolefin pressure-piping joints according to ASTM D 2657.

C. Plastic-Piping Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.

D. Plastic-Piping Socket-Weld joints: Make drainage-piping joints according to ASTM D 3311 and ASTM F493.

E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with both system materials.

3.5 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 23.

B. Refer to Division 23. Install the following:

1. Vertical Piping: MSS Type 8 or MSS Type 42, riser clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 23.

D. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

E. Support vertical piping and tubing at base and at each floor.

F. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

G. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 42 inches with 3/8-inch rod.
2. NPS 2-1/2 and NPS 3: 42 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.

H. Install supports for vertical CPVC piping every 72 inches.

I. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2: 33 inches with 3/8-inch rod.
2. NPS 2-1/2 and NPS 3: 42 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.

J. Install supports for vertical PP piping every 72 inches.

K. Install vinyl-coated hangers for PVDF piping with the following maximum horizontal spacing and minimum rod diameters:

1. All Sizes: Install continuous support for piping with liquid above 140 deg F.
2. NPS 1/2 and Smaller: 30 inches with 3/8-inch rod.
3. NPS 3/4 to NPS 1-1/2: 36 inches with 3/8-inch rod.
4. NPS 2: 36 inches with 3/8-inch rod.
5. NPS 2-1/2 and NPS 3: 42 inches with 1/2-inch rod.
6. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
7. NPS 6: 48 inches with 3/4-inch rod.

L. Install supports for vertical PVDF piping NPS 1-1/2 every 48 inches and NPS 2 and larger every 72 inches.

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect chemical-waste piping to sinks, specialties, accessories, and equipment. Use chemical-resistant coupling, adapter, or fitting as required for materials being joined.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Arrange for electric-power connections to specialties and devices that require power. Electric power, wiring, and fused disconnect switches are specified in Division 26 Sections.

3.7 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in Division 23.

3.8 FIELD QUALITY CONTROL

A. Chemical-Waste Piping Inspection:

1. Do not enclose, cover, or put drainage and vent piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping system before concealing after system roughing-in and before setting fixtures and equipment.
    b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspections: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Chemical-Waste Piping Testing: Test systems according to procedures of authorities having jurisdiction or, in absence of published procedure, according to the following:

1. Test for leaks and defects in new piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Rough Plumbing Test Procedure: Test piping at completion of piping roughing-in. Tightly close all openings in piping system, and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before test starts through completion of test, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures and equipment have been set and their traps filled with water, test connections and prove gastight and watertight. Plug stack openings on roof and building drain where it leaves building, and introduce air into system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of fixture to measure pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Use procedures prescribed by authorities having jurisdiction or, if not prescribed, use procedures described below:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Clean piping by flushing with potable water.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain neutralization systems. Refer to Division 1.

END OF SECTION 226600

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SECTION 226700 - LABORATORY PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping and related specialties for the following medical gas systems:

1. Laboratory compressed air piping, designated "lab air."
2. Laboratory vacuum piping, designated "lab vacuum."

B. Related Sections include the following:

1. Division 22 Section "Plumbing Equipment and Fixtures" and accessories.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Special-purpose valves.

B. Wiring diagrams for medical gas alarm systems and tanks. Differentiate between manufacturer-installed and field-installed wiring.

C. Coordination Drawings: For medical gas systems, including relationship to other services that serve same work areas.

D. Product Certificates: Signed by manufacturer certifying that copper tubing complies with NFPA 99, Paragraph 4-3.1.2.2, "Gas Piping Systems (General)."

E. Certificates of Shop Inspection and Data Report: As required by ASME Boiler and Pressure Vessel Code.

F. Inspection and test reports specified in "Field Quality Control" Article in Part 3 of this Section.

G. Maintenance Data: For specialties to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Testing Agency Services: Owner will provide independent testing agency services under separate contract to inspect, test, and certify medical gas piping and components, except for inspections and tests specified in "Field Quality Control" Article in Part 3 of this Section.

B. Testing Agency Qualifications: Demonstrate to Architect's satisfaction, based on Architect's evaluation of criteria conforming to ASTM E 699 that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. Listing and Labeling: Provide electrically operated specialties specified in this Section that are listed and labeled.

1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.

D. Comply with NFPA 99, "Health Care Facilities."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping with sealing plugs in ends or with other end protection.

1. Store precleaned and sealed medical gas pipe, fittings, valves, and specialties with sealing plugs and sealing packaging intact.
2. Label medical gas pipe, fittings, valves, and specialties that have been precleaned but have seal or packaging that is not intact, with temporary labels indicating that cleaning is required before installation.

PART 2 - PRODUCTS

2.1 PIPE AND TUBES

A. Precleaned, Hard Copper Tube: ASTM B 819, Type K or Type L, seamless, drawn temper, factory cleaned, purged, and sealed for medical gas service. Include marking or labeling "CLEANED FOR MEDICAL GAS SERVICE," "CLEAN FOR OXYGEN SERVICE," "NITROGENIZED."

B. Soft Copper Tube: ASTM B 88, Type K water tube, seamless, annealed temper. Tube may be factory cleaned, purged, and sealed for medical gas service according to ASTM B 819 or field cleaned, purged, and sealed as specified in "Preparation" Article in Part 3. Include marking or labeling "CLEANED FOR MEDICAL GAS SERVICE," "CLEAN FOR OXYGEN SERVICE," "NITROGENIZED."

2.2 PIPE AND TUBE FITTINGS

A. Wrought-Copper Fittings: ASME B16.22, solder-joint, pressure type. Fittings may be factory cleaned, purged, and sealed for medical gas service according to ASTM B 819. Include

marking or labeling "CLEANED FOR MEDICAL GAS SERVICE," "CLEAN FOR OXYGEN SERVICE," "NITROGENIZED."

B. Bronze-Tube Flanges: ASME B16.24, Class 300.

2.3 JOINING MATERIALS

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

B. Brazing Filler Metals: AWS A5.8, BCuP (copper-phosphorus) series alloys. Flux is prohibited.

C. Threaded-Joint Tape: PTFE plastic.

D. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos free, and suitable for oxygen use.

2.4 VALVES AND VALVE BOXES

A. Ball Valves, 3-Inch NPS and Smaller: MSS SP-110, bronze-body, full-port valve rated for 300-psig working pressure, with chrome-plated brass ball, PTFE or TFE seals, blowout-proof stem, threaded or braze-joint ends, and handle designed for quarter turn between open and closed positions.

1. Include union-type body with bolted swing-away center section.
2. Include factory-cleaned, factory-sealed for oxygen use, and factory-installed, ASTM B 88, Type K, copper-tube extensions with pressure gage installed downstream from valve in pressure systems and upstream from valve in vacuum systems.

B. Check Valves, 3-Inch NPS and Smaller: Bronze-body, straight-through pattern, spring-loaded ball check valve, designed for 300-psig minimum working pressure.

C. Safety Valves: Bronze body with settings to match system requirements.

1. Pressure Safety Valves: ASME construction.
2. Vacuum Relief Valves: Equipment manufacturer's option.

D. Pressure Regulators: Brass or bronze body and trim; spring-loaded, diaphragm-operated, relieving type; manual pressure-setting adjustment; rated for 250-psig minimum inlet pressure; and capable of controlling delivered air pressure within 0.5 psig for each 10-psig inlet pressure.

E. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, 200-psig minimum working-pressure rating, capable of automatic discharge of collected condensate.

2.5 IDENTIFICATION

A. Refer to Division 23 Section "Mechanical Identification" for piping, valves, gages, alarms, accessories, and labels for bulk storage tanks.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: When precleaned piping must be recleaned because of exposure, perform the following procedures:

1. Clean pipe and pipe fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service, according to CGA G-4.1, "Cleaning Equipment for Oxygen Service."
2. Wash piping and components in hot, alkaline cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.

a. Scrub to ensure complete cleaning.
b. Rinse with clean, hot water after washing to remove cleaning solution.

3.2 PIPING APPLICATIONS

A. General: Refer to Part 2 of this Section for the following materials:

3.3 PIPING INSTALLATION, GENERAL

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Install supports and anchors according to Division 23 Section "Hangers and Supports."

1. Spacing between Hangers: As described in NFPA 99.

C. Valve Applications: Use ball valves specified in this Section for main shutoff and zone valve duties.

D. Purging: Purge medical gas piping using oil-free, dry nitrogen after installing piping but before connecting to service-outlet valves, alarms, and gages.

3.4 JOINT CONSTRUCTION

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.5 SPECIALTIES INSTALLATION

A. Install specialties according to NFPA 99 and manufacturer's written instructions.

B. Install manifolds firmly anchored to substrate and with seismic controls as indicated.

3.6 CONNECTIONS

A. Install piping next to equipment to allow service and maintenance.

B. Connect compressed air and vacuum piping to equipment, gas manifolds, and accessories with unions. Install with ball valves and strainers.

1. Install flexible pipe connectors on air piping connections to air compressors, vacuum piping connections to vacuum units, and where indicated.
2. Install thermometers on air-compressor discharge piping, air receiver tanks, vacuum receiver tanks, and where indicated.
3. Install pressure gages on air-compressor discharge piping, air receiver tanks, vacuum receiver tanks, and where indicated.
4. Install pressure regulators downstream from air compressors, dryers, purification units, and filter assemblies.

C. Install lab air, and vacuum piping and electrical connections to lab air and vacuum alarm system components.

D. Arrange for electric-power connections to specialties and devices that require power. Electric power, wiring, and disconnect switches are specified in Division 16 Sections.

3.7 LABELING AND IDENTIFICATION

A. Install labeling on valves and alarm panels according to requirements of NFPA 99.

B. Refer to Division 23 Section "Mechanical Identification" for labeling and identification materials.

C. Captions and Color Coding: Use the following color coding for specialties, when specified and where required by NFPA 99:

1. Lab Air: Black or white letters on yellow background.
2. Lab Vacuum: Black letters on white background.

D. Label piping systems operating at other than standard pressure with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Pressure Test: Subject each piping section of each system, except high-pressure nitrogen, to test pressure of from 230 to 200 psig and high-pressure nitrogen systems to test pressure of 250 psig with oil-free, dry nitrogen before attaching system components, after installing station outlets with test caps (when supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water.

B. Standing-Pressure Test: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test at 20 percent above

normal line pressure, but not less than 66 psig. Subject vacuum and evacuation systems to 12- to 18-in. Hg minimum vacuum instead of pressure test.

C. Repair leaks, replace damaged components with new materials, and retest system until satisfactory results are obtained.

D. Provide oil-free, dry nitrogen; materials; equipment; and labor required for testing.

E. Prepare written reports of tests results, including corrective action.

F. Certify that lab air and vacuum systems comply with requirements specified, that tests were properly performed, and that test results were satisfactory.

G. Inspect outlets and inlets, gages, alarms, and zone valves for proper labeling for gas service and function.

H. Inspect manifold supply systems for installation and operation as required by NFPA 99, "Gas and Vacuum Systems."

3.9 COMMISSIONING

A. Startup Services: Engage a factory-authorized service representative to inspect alarm system installation and to provide startup service.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment discovered by service representative.

B. Perform the following final checks before startup:

1. Verify that specified tests of piping are complete.
2. Check safety valves for correct settings. Ensure settings are greater than air-compressor discharge pressure, but not greater than rating of system components.

3.10 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to demonstrate procedures for alarm system startup and shutdown, preventive maintenance and servicing, and troubleshooting. Review operating and maintenance information.

B. Provide written notice 7 days in advance of demonstration.

END OF SECTION 226700