SECTION 000107 – SEALS PAGE

Professional Certification: I hereby certify that these documents were prepared or approved by me and that I am a duly registered Professional Engineer in the State of Washington. My stamp only applies to the sections listed below.

Benjamin Roush, PE (Mechanical & Fire Protection), LEED AP BD+C, CCP, BEMP, BEAP License No. 45144	210500 210505 210507 210523 210548 210553 210719	 11/07/22
Kevin Chadwick, PE, LEED AP BD+C License No. 45329	220500 220505 220507 220553 220719 220800 221005 223000 224005 230130.51 230500 230505 230507 230548 230553 230593 230713 230800 230900 233100 233300 233600 233700 233813	 11/07/22

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Snohomish County Sheriff West Precinct
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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. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner's separate contracts.
4. Owner-furnished/Owner-installed (OFOI) products.
5. Contractor's use of site and premises.
6. Specification and Drawing conventions.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. Project Identification: Snohomish County Sheriff West Precinct

1. Project Location: 9901 24th Place West, Everett WA 98204.

B. Owner: Snohomish County

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. This project includes tenant improvements for approximately 27,300 square feet of space on the main floor of a 2-story Type III-B building as well as related site work and other Work indicated in the Contract Documents.

B. Type of Contract:

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

1.6 WORK UNDER OWNER'S SEPARATE CONTRACTS

A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.

B. Concurrent Work: Owner will award and may assign to Contractor if successful bidder separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.

1. Airport Admin/Sheriff Parking Lot Revisions: See Civil reference drawings.

C. Future Work Not Part of this Contract: The Contract Documents include requirements that will allow Owner to carry out future work following completion of this Project; provide for the following future work:

1. Office furnishings, access control/security systems.

1.7 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. The Owner will furnish and install products indicated.

B. Owner-Furnished/Owner-Installed (OFOI) Products:

1. Emergency Generator.

2. Access Control/Security System.

3. Conference Room Electronic Calendar System.

4. Office Furnishings.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

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

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

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. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under Owner's separate contracts.
4. Owner-furnished/Owner-installed (OFOI) products.
5. Contractor's use of site and premises.
6. Work restrictions.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. Project Identification: Snohomish County Paine Field Tenant Improvement

1. Project Location: 9901 24th Place West, Everett WA 98204.

B. Owner: Snohomish County

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. This project includes tenant improvements for approximately 18,177 square feet of space on the main floor and second floors of a 2-story Type III-B building as well as related site work and other Work indicated in the Contract Documents.

B. Type of Contract:

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

1.6 WORK UNDER OWNER'S SEPARATE CONTRACTS

A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.

B. Concurrent Work: Owner will award and may assign to Contractor if successful bidder separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.

1. Airport Admin/Sheriff Parking Lot Revisions: To Be Determined

1.7 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. The Owner will furnish and install products indicated.

B. Owner-Furnished/Owner-Installed (OFOI) Products:

1. Electronic Calendars at Conference Rooms.

2. Badge Readers at secure entrances.

3. Office Furniture.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

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

1.9 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying 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 form acceptable to Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions 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 substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
h. Research reports evidencing compliance with building code in effect for Project, from ICC-ES
i. Detailed comparison of Contractor's construction schedule using proposed substitutions 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 date of receipt of purchase order, lack of availability, or delays in delivery.
j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
k. 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.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. 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:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution is compatible with other portions of the Work.
c. Requested substitution has been coordinated with other portions of the Work.

B. Substitutions for Convenience: Not allowed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Owner will issue a Change Order for signatures of Owner and Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Web-based Project management software package.
6. Project meetings.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. 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, telephone number, and email address 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.

B. Key Personnel Names: Within 15 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, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.5 GENERAL COORDINATION PROCEDURES

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.

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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. 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.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.

2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

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

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

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow fourteen days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.

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.

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within **5** days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly.

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

G. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.7 PROJECT MEETINGS

A. General: The Contractor will 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 a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.

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 use.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of Proposal Requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    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.

4. 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 use.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of RFIs.
14) Proposal Requests.
15) Change Orders.
16) Pending changes.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Site condition reports.
6. Unusual event reports.

1.2 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

D. Daily Construction Reports: Submit at monthly intervals.

1.3 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion

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

B. Activities: Treat each floor or separate area as a separate numbered activity for each main 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.

C. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities.

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 Final Completion percentage for each activity.

D. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

E. 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.

1.5 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.6 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. Testing and inspection.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.

11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 013100 "Project Management and Coordination".
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
4. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
5. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

C. Shop Drawings, product data, samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate, for those portions of the Work for which submittals are required., how Contractor proposes to confirm to the information given and the design concept expressed in the Contract Documents.

1.2 DEFINITIONS

A. Shop Drawings: Shop drawings include specially-prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements, and similar information not in standard printed form for general application to several projects. Reproduction of Contract Document drawings are not considered to be shop drawings unless approved by the Owner.

B. Product Data: Product data includes standard printed information on materials such as SDS documentation, products and systems, not specially-prepared for this project, other than the designation of selections from among available choices printed therein.

C. Samples: Samples include both fabricated and un-fabricated physical examples of materials, products, and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or (where indicated) for more detailed testing and analysis.

D. Coordination Drawings: Coordination drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
   1. Preparation of Coordination Drawings is specified in Section 01 31 00 Project Management & Coordination and may include components previously shown in detail on Shop Drawings or Product Data.

E. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL PROCEDURES

A. Provide a submittial on every product and material used in the Project, Before submittal of shop drawings, brochures, and lists, Contractor shall carefully review same for proper identification, completeness, dimensions, and technical applicability to the Contract Document requirements and note all corrections, items needing clarification, additional comments, and the like. Upon thorough review and subsequent acceptance by the Contractor, if so accepted, Contractor is to note its approval together with said notes or amendments thereto for compliance with the Contract Documents by suitable stamp, date and the signature of the Contractor or its authorized representative. Submittals will be returned to the Contractor without action if the items submitted are not stamped, signed, and identified as approved or approved as noted or other similar language indicating approval by the Contractor, or if the submittal is obviously not thoroughly reviewed.

B. Submission of shop drawings and samples shall be accompanied by one (1) transmittal letter containing Project name, Contractor’s name, number of drawings and samples, titles and other pertinent data.

C. Many products are specified by one or more named products/manufacturers. In those circumstances where Contractor submits an unnamed, non-prior approved product/manufacturer during this ‘shop drawing’ phase, said submittal shall be submitted in conformance with product substitution requirements.

D. Coordinated preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   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 elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
   a. The Contractor shall provide submittals requiring coordination with other submittals to the District at one time. The Architect will review submittals as received, provide comments, and return them to the Contractor. If the Coontractor did not submit all submittals requiring coornication as the same time, and a lter submittal identified conflicts, the Contractor will be responsible for all costs associated with changes necessary to properly coordinate the installation of the materials.
3. To avoid the need to delay installation as a result of the time required to process submittals, the Contractor shall anticipate the review times noted in this section and anticipate the possibility of a resubmittal or rejected submittal and the effect that action would have on the Project schedule.
   a. Submittals requiring color selection and material selection are interdependent on receiving all submittals at the same time that have such selection requirements. Allow twenty (20) working days from the date of receipt of the last such submittal by the Contractor for the Architect to complete color selections and return from the Architects office.
   b. For all other submittals, allow ten (10) working days after receipt by the Architect to complete the initial review and mail out from the Architect's office.
   c. If the Architect must delay processing a submittal to permit coordination with subsequent submittals, then ten (10) working days will begin upon receipt of the last such coordination submittal from the Contractor.
   d. If several submittals are provided by the Contractor as the same time, allow twenty (20) working days after receipt by the Architect to complete the initial review and return from the Architect. Provide and "Order of Priority List" to the Architect with the submittal.
   e. If an intermediate submittal is necessary, process the same as the initial submittal.
   f. Allow ten (10) working days for reprocessing each submittal after receipt.

E. Electronic Submittals: Identify and incorporate information as follows:
   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., Project Name-09 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g. Project Name-09 10 00.01.A).
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by the Architect and/or their representative.
   4. Transmittal Form for Electronic Submittals: Use software-generated form or electronic form acceptable to the Architect, containing the following information:
      a. Project name and job number.
      b. Date.
      c. Name and address of the Architect.
      d. Name and address of the Contractor, subcontractor, supplier and manufacturer as appropriate.
      e. Submittal number or other unique identifier, including revision identifier.
      f. Number and title of appropriate Specification Section.

g. Drawing number and detail references, as appropriate.
h. Location(s) where product is to be installed, as appropriate.
i. Other necessary identification.
j. Submittal and Transmittal distribution record.
k. Remarks.

F. Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned through the Contractor without action. Contractor to include a PDF of all submittal documents at all stages of review (initial and revised).
1. Submittal to contain no more than one Specification Division in each transmittal.
2. Record relevant information, deviations, and requests for data, including minor variations and limitations from the Contract Documents.
3. For a resubmittal, Contractor to note on the transmittal the page numbers that were modified in any way from the previous submittal or added.
4. Shop drawings, product data, samples, and mocku-ups as required for submissions by the technical specification sections are to be submitted for Architect's review/acceptance. The number of submittals required is noted in parenthesis.
   a. Shop Drawings: One (1) set for initial and revised submittals.
   b. Product Data: One (1) set for initial an revised submittals.
   c. Samples: As required by any technical specification section, with a minimum of two (2).
   d. Mock-ups: As required by any technical specification section.
   e. Demonstrations: As required by any technical specification section.
   f. Reference applicable mechanical and electrical technical specification sections for additional submittal requirements.
5. Material and Color Selection: Submit samples of actual colors of materials.

G. Resubmittals: with each resubmittal Contractor to include all previously submitted information including requested revisions, correction and/or additions.

1.5 SHOP DRAWINGS

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

B. Include fabrication and installation drawings, setting diagrams, schedule, patterns, templates, and similar drawings, Include the following information:
1. Dimensions.
2. Identification of products and materials included.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Any deviation from contract drawings or specifications.
6. Date when review has to be finalized to meet schedule.

C. Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2" x 11", but no larger than 24" x 36".

D. Shop drawings shall clearly indicate the correct configurations and relative sizes, materials, metal gauges, etc. of the various components and the proposed methods of fabrication, required clearances, supports and any other pertinent data.

E. All items shown on Shop Drawings that do not conform to plans and specifications shall be specifically Architect's stamp of review shall not include approval of unauthorized changes in the Contract Documents, except where specific written approval is given.

F. Distribution: Contractor shall 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.

1.6 PRODUCT DATA

A. Product data includes Safety Data Sheets (SDS), manufacturer's printed installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves.
   1. Where product data must be specifically prepared because standard printed data is not suitable, submit as Shop Drawings.

B. All products with an SDS to be used during construction must be approved by the Architect prior to use on Owner's property.

C. Mark each copy to show applicable choices and options and indicate the applicable information on selected products. Include the following information:
   1. Manufacturer's printed recommendations.
   2. Compliance with recognized trade association standards.
   3. Compliance with recognized testing agency standards.
   4. Application of testing agency labels and seals.
   5. Notation of dimensions verified by field measurement.
   6. Notation of coordination requirements.
   7. Any deviation from Contract Drawings or Specifications.
   8. Date when review has to be finalized to meet schedule.

D. The Contractor is responsible for providing certification that all construction materials used on the Project are 100% free of asbestos and lead.

1.7 SAMPLES AND MOCK-UPS

A. Submit samples and mock-ups that are identical with the material or product proposed. Samples include partial sections of components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
   1. Package samples to facilitate review. Include the following:
      a. Generic description of the sample.
      b. Sample source.
      c. Product name or name of manufacturer.
      d. Compliance with recognized standards.
      e. Availability and delivery time.
      f. Specification section.

B. Submit samples and mock-ups for review of kind, color, pattern, and texture, for a comparison of these characteristics before the actual component installation and after final submittal.
   1. Where variation in color, pattern, texture or other characteristics are inherent in the material, submit not less than four (4) units to show approximate limits of the variations.

C. Where samples are for selection of appearance characteristics from a range of standard choices, submit a full set of choices for the material or products.

D. Where mock-ups are required, provide full-size mock-ups using the same materials, methods, workmanship, and quality that will be used in the Work. Personnel constructing and assembling mock-up shall be the same personnel that will perform the actual final units of Work at the Project Site. Use means, methods, and techniques proposed for final installation.

E. Notify Architect x not less than seven (7) working days prior to date when mock-ups will be constructed or installed.

F. Obtain Archtiect's review and acceptance of mock-ups prior to starting fabrication and installation of the Work the mock-up represents.

G. Review and Acceptance of mock-ups by the Architect does not constitute approval of deviations from requirements of the Contract Documents that are contained in mock-ups, unless such deviations are specifically accepted in writing by the Architect.

H. Maintain sets of approved samples and mock-ups, at the project site, for quality comparisons throughout the course of construction.

I. Where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for the project record.

1.8 DELEGATED DESIGN SERVICES

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

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contactor to be designed or certified by a design professional.
   1. Indicated that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 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 measurements. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See Section 01 78 00 Closeout Submittals.

1.10 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

B. 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.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1. Substantial Completion procedures.
2. Final Completion procedures.

B. Related Requirements:
1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 CLOSEOUT PROCEDURES

A. The Contractor’s superintendent shall perform a review of all installed work (general, mechanical, electrical) and note any corrections, touch-up, or otherwise restore marred, exposed surfaces that is necessary to comply with the Contract Document requirements before requesting the Architect to review the Work. The Contractor shall develop a written correction list (pre-punch list) and track the completion of the items by initialing and dating each item, signifying that it has been reviewed and properly completed.

B. Comply with items under Substantial Completion by submitting documentation and the Contractor’s initialed correction list to the Architect with a letter requesting the Architect’s review of the Project.

C. Upon receipt of the information from the Contractor the Architect will visit the site and review the Project for compliance with the Contract Documents. The Architect will develop a punch list of any work that still needs correction. If the list is incidental corrective punch work to complete, the Architect will issue the notice of Substantial Completion with the corrections list attached. If the correction work is still significant, the Contractor shall complete the corrections in the same format as its pre-punch list and request additional reviews by the Architect as necessary to establish that the Project is complete to the point where the Substantial Completion notification can be issued.

D. Provide operation and maintenance instruction on installed equipment to the Owner.

E. The Contractor shall correct any outstanding punch list items and submit all other close-out documentation to the Architect as indicated under Final Completion. When punch lists have been verified by the Architect as being complete and all documentation is satisfactory and accepted by the Owner, the Owner will issue its notification of Final Completion.

1.4 PROJECT RECORD DOCUMENT SUBMITTAL

A. Submit all documents to the Owner prior to final Application for Payment. The following submittal procedure shall occur prior to Final Completion.

B. Submit original copy of as-builts (drawings and specifications) to the Architect for review.

C. Compile and organize any drawings of schedules in the Project Manual onto sheets of the same size as the Contract Drawings and submit with other record documents.

D. Should the submittal be unacceptable for any reason, the Contractor shall make requested modifications and resubmit to the Architect. Continue to resubmit as necessary until the submittal is acceptable.

E. Upon acceptance of the submittal, the Contractor shall submit to the Owner three (3) sets of prints, record specifications, and Contractor’s original marked-up as-builts.

1.5 OPERATIONS AND MAINTENANCE DATA AND MANUALS

A. Refer to Section 01 78 23 Operations and Maintenance Data.

B. Submit, in digital format acceptable to the Owner, preliminary Operating and Maintenance Manuals for operational and non-operational equipment for review by the Owner. Submit for each system upon attaining 50% system completion.

C. Submit one (1) copy of completed documents fifteen (15) days prior to final inspection, in a digital format acceptable to the County. This copy will be reviewed and returned after final inspection, with County comments. Revise content of all document sets as required prior to final submission.

D. Within ten (10) days following receipt of the Owner’s approval and comments, and prior to County training, Contractor shall prepare and transmit to the County three (3) printed copies and one (1) digital copy of each of the above manuals.

1.6 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

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

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to County.

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: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

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 designated portion of Project:
   a. Leave Project clean and ready for occupancy.

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:
1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

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 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) 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, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. 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. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
4. 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.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: 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: 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 and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. 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.

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."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. 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.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

A. 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.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

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.

B. 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. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has 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.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
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.

D. 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.

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

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

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

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.

B. 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 warranties and bonds as described below.

C. 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 and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; 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.

a. 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.

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.

E. 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 video recording, if available.

F. 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.

G. 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.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. 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.

J. 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 maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. 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.

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

D. 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.

E. 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.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. 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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:
1) Submit PDF electronic files of scanned record prints and one set of file prints.

b. Final Submittal:
1) Submit PDF electronic files of scanned Record Prints and three set of file prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories and one paper copy of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories and one paper copy of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

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 provide information for preparation of corresponding 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 acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding photographic documentation.

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.
    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 and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints 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. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as for the original Contract Drawings.

C. 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. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect and Construction Manager.
e. Name of Contractor.

1.5 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. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
3. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. 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.

C. Format: Submit Record Product Data as annotated PDF electronic file.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 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.

B. Format: Submit miscellaneous record submittals as PDF electronic file of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents 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 and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 024119 - SELECTIVE 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. Section Includes:

1. Demolition and removal of selected portions of building or structure.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

C. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

1.10 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
   1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    d. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect equipment that have not been removed.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site.

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.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, other pozzolans, slag cement, and silica fume; materials subject to compliance with requirements.

B. Supplementary Cementitious Materials: Cementitious Materials other than Portland cement.

C. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.
2. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical couplers, tie spacing, spiral spacing, hoop spacing, and supports for concrete reinforcement.

D. Embedded Item Placement Drawings: Drawings indicating the location and type of anchorages, sleeves or other items to be embedded in cast-in-place concrete members and surfaces.

1. Submit coordinated drawings combining embedded items from all trades.
2. Locate embedded items relative to edges of and openings within concrete members.

E. Samples: For vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories. Include mill test certifications for ASTM A 615, Grade 60, bars used as special ductile quality (SDQ) reinforcement.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Evaluation Reports: ICC-ES or IAPMO-UES report certifying product compliance with IBC 2018 for each of the following:

1. Headed Deformed Bars.
2. Mechanical Bar Couplers.
3. Adhesives for post-installed dowels.
4. Post-installed anchors.

F. Curing Procedures: Written procedures indicating proposed methods for curing concrete and that address the following:

1. Timing and rate of application of Evaporation Retarder.
2. Timing of installation of Moisture-Retaining Cover and Absorptive Cover.
3. Duration of and methods for providing moist cure of Formed and Unformed Surfaces.
4. Adjustments to curing procedures in the event of cold weather or hot weather as defined by ACI 306.1 and ACI 305.1, respectively.

G. Floor surface flatness and levelness measurements: indicating compliance with specified tolerances.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency**,** acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Keep reinforcement off ground by using pallets, dunnage, or other supports.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average of highest and lowest ambient temperature from midnight to midnight is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 305.1 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.9 REDESIGN

A. Redesign or Departures from Requirements of the Contract Documents Initiated by Contractor:

1. Obtain written acceptance from the Architect and Architect's consultants.
2. Bear costs for Contractor-initiated or construction error-caused changes to type, form, system, or details of construction from those indicated by the Contract Documents.
3. Pay fees required by Architect and Architect's consultants for review of such changes.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 "Specifications for Structural Concrete."
2. ACI 117 "Specification for Tolerances for Concrete Construction and Materials."
3. ACI 305.1 "Specification for Hot Weather Concreting."
4. ACI 306.1 "Standard Specification for Cold Weather Concreting."
5. ACI 308.1 "Specification for Curing Concrete."
6. ACI 318 "Building Code Requirements for Structural Concrete."

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.3 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to CRSI RB4.1-2016, "Supports Used for Reinforcement in Concrete." Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI RB4.1-2016 of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

B. Headed Deformed Bars: ASTM A 970/A 970 M.

C. Mechanical Bar Couplers: Type 1 or Type 2 as indicated. Type 1 mechanical splices shall develop 125 percent of the specified yield strength of the spliced bars in both tension and compression. Type 2 mechanical splices shall develop the specified tensile strength of the spliced bars in tension in addition to meeting Type 1 mechanical splice requirements.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150, Type I Type II, gray. Supplement with the following:
2. Fly Ash: ASTM C 618, Class F or C.
3. Slag Cement: ASTM C 989, Grade 100 or 120.
4. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 3S Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: Unless maximum coarse aggregate size is otherwise specified, the maximum aggregate size shall not exceed:

a. Three-fourths of the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, prestressed reinforcement, individual tendons, bundled tendons or ducts.
b. One-fifth of the narrowest dimension between the sides of the forms.
c. One-third of the depth of the slabs or toppings.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: 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. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
7. Viscosity Modifier: ASTM C 494/C 494M, Type S.

F. Water: ASTM C 94/C 94M and potable.

1. Do not use undocumented nonpotable water for concrete mixes.
2. Recycled water may be used in conformance with ASTM C 94, including optional chemical limits
3. Wash water may be used in conformance with ASTM C1602.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; of width and thickness indicated; formulated from neoprene or urethane.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M) for normal weight concrete.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Concrete mix designs shall comply with the requirements of the structural drawings.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Slag Cement: 50 percent.
4. Silica Fume: 10 percent.
5. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
6. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash and pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to the maximum allowed in ACI 318 with the Exposure Class listed on the Contract Documents.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
2. Batch Tickets: Include the amount of water in the batch from the plant and the remaining water that may be added at the site, if any.

B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M) to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods and embedded structural steel items, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS

A. Formwork that does not support weight of concrete in place, such as for sides of beams, walls columns and similar parts of the Work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Leave formwork that supports weight of concrete in place, such as for beam soffits, joists, slabs, and other structural elements, a minimum of 3 days and until concrete has achieved its design compressive strength, whichever is longer.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

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

3.4 VAPOR RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, terminate and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" and CRSI RB4.1 “Standard for Supports for Reinforcement Used In Concrete” for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Defective Work: The following reinforcing steel work will be considered defective and shall be removed and replaced by the Contractor at no additional cost to the Owner:

1. Bars with kinks or bends not shown on the drawings.
2. Bars damaged due to bending or straightening.
3. Bars heated for bending.
4. Reinforcement not placed in accordance with the drawings.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
2. Roughen surfaces of joints to full amplitude of approximately 1/4 inches as indicated.

C. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish that matches adjacent existing surfaces.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures in accordance with submitted Curing Procedures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

1. Evaporation Retarder may be omitted if the Curing Procedures demonstrate that moisture loss will not exceed 0.2 lb/sq. ft. x h before and during finishing operations. Such determination must be based upon concrete mix characteristics and ambient environmental conditions at time of placement.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, and sealers from joints; leave contact faces of joints clean and dry.

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

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding

with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Perform structural repairs of the following cracks using epoxy resin adhesive by injection as directed by the Architect.

1. Cracks in excess of 0.01 inch which extend through the full depth of a slab or wall.
2. Cracks in excess of 0.015 inch which do not extend through the full depth of a slab or wall.
3. Cracks which are subject to allowing water leakage though the crack.

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

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Tests and Inspections: As indicated on the structural drawings.

C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

D. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

G. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

END OF SECTION 033000

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Miscellaneous masonry accessories.

B. Related Sections:

1. Division 05 "Structural Steel Framing" for embedded anchors for connection to and support of structural steel frame.
2. Division 05 “Steel Joist Framing” for embedded anchors for support of steel joists.

1.3 DEFINITIONS

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

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

1.5 INFORMATIONAL SUBMITTALS

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

1. Masonry units.

    a. Include data on material properties.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Miscellaneous masonry accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

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

C. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 unless modified by requirements in the Contract Documents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Deliver, store and handle steel reinforcement to prevent bending and damage. Keep reinforcement off ground by using pallets, dunnage, or other supports.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C 90.

1. Unit Compressive Strength: See Structural Drawings.
2. Density Classification: Medium weight, unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from lintel CMU blocks with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.Mortar Cement: ASTM C 1329.

D. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

2.6 EMBEDDED FLASHING MATERIALS

A. Coordinate with Division 07 “Sheet Metal Flashing and Trim.”

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; of width and thickness indicated; formulated from neoprene or urethane.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

2.8 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion or Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For reinforced masonry, use Type S.
2. For mortar parge coats, use Type S.

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 TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

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

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern: Unless otherwise indicated, lay masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

G. Fill all cores in hollow CMUs with grout, unless otherwise indicated.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid lintels and 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.

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.

3.6 LINTELS

A. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.7 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.8 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Tests and Inspections: As indicated on the structural drawings.

3.9 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.10 MASONRY WASTE DISPOSAL

A. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 050513 – SHOP-APPLIED COATINGS FOR METAL

PART 1 - GENERAL

1.1 DEFINITIONS

A. Element - Collective term denoting a metal item, including its sub-parts, subject to this specification.

B. Exterior Surfaces –Element surfaces located outside the building envelope.

C. Interior Surfaces – Element surfaces located within the building envelope.

D. Building Envelope – The metal roof deck, exterior siding and any other elements separating the interior of the building from weather.

1.2 DESCRIPTION OF WORK

A. The work includes the requirements to provide the pigmented film or coating with all pre-finishing work, accessories, auxiliary materials, and equipment required to finish the surfaces of the Element as indicated on the drawings or noted within these specifications.

B. Metallic surfaces of the Element shall be painted except nameplates, and wearing or internal surfaces of mechanical parts.

C. All external surfaces of the Element which will not be painted, and all threaded holes in the Element shall be treated with corrosion preventive “TECTYL 506” or “DINITROL” after all painting applications are finished.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. The provisions and intent of the Contract, including the General Conditions, Special Conditions, and other sections of the General Requirements, apply to this work as if specified in this section. Work related to this section is described in:

1. Section 099000 – Painting and Coating

2. Section 051200 – Structural Steel Framing

3. Section 055000 – Miscellaneous Metal Fabrications

1.4 SUBMITTALS

A. Submittals shall be made as noted in Section 0990001.4.

1.5 ACCEPTABLE PAINT MANUFACTURERS

A. ICI (Imperial Chemical Industries).

B. Tnemec.

1.6 QUALITY ASSURANCE

A. Application

1. Shall be by an experienced painter having used materials and processes similar to those specified herein or a painting firm employing experienced personnel.

B. Paint Supplier's Specifications, Directions, and Recommendations

1. Conform to paint supplier's specifications, directions, and recommendations for best results in the use of each of their products for each condition. If paint supplier's directions are at variance with these specifications, report the discrepancy to the Owner for direction.

C. Paint Supplier's Representative

1. The paint supplier's representative shall supervise and inspect all paint applications.

PART 2 - PRODUCTS

2.1 PAINT SYSTEM

A. Exterior Surfaces

1. Prime Coat

a. Tnemec - Series 90, 90-97 or H90-97 MCU Zinc applied to achieve 2.5 – 3.5 mils DFT except on faying surfaces for 3.0 mils maximum DFT.

2. Intermediate Coat

a. Tnemec – Series 27 F.C. Typoxy applied to achieve 2.5 – 5.0 mils DFT.

3. Finish Coat

a. Tnemec Series 30 Spra-Saf acrylic polymer applied to achieve 2.0 – 4.0 mils DFT.

B. Interior Surfaces

1. Prime Coat

a. ICI/Devoe Devran 201 polyamide epoxy, applied to achieve 2.0 – 4.0 mils DFT.

2. Intermediate Coat

a. ICI/Devoe Devflex.

3. Finish Coat

a. ICI/Devoe Devflex.

C. Field Painting and Touch-up

1. Exterior

a. Prime, intermediate and finish coat – Same as specified above.

2. Interior coat same as above

a. Prime, intermediate and finish coat – Same as specified above.

2.2 COLORS

A. Finish coat color: Manufacturer's White. If more than one shade of white is available, submit sample for approval by the Construction Manager prior to purchasing.

PART 3 - EXECUTION

3.1 GENERAL

A. All work shall be done in a neat and workmanlike manner.

B. Apply the paints in accordance with the paint supplier's recommendations as to the application, humidity, weather, temperature conditions and coating thickness.

C. Use clean equipment and brushes when applying paint; spread paint materials evenly, without runs, sags, laps, or brush marks, without variations in color, texture, or sheen, and without "holidays".

D. The MCU organic zinc on faying surfaces (bolted connections) shall not exceed 75 microns (3 mils) maximum.

E. The intermediate coat shall not be applied until:

1. Welding has been complete (Note: Welding includes any miscellaneous structural mechanical or electrical brackets).

2. The MCU organic zinc prime coat has cured and been tested for thickness.

3. If there is any question that relative humidity is too low for proper curing (i.e. <50 percent), the paint supplier's representative shall inspect and certify proper cure.

F. Vary colors or sheens between coats and apply all coats to uniform thicknesses.

G. Surfaces which do not require painting shall be masked or otherwise protected during the painting of adjacent work. Threaded bolt holes shall be masked with tight fitting plugs.

H. Cut sharp lines against glass, other materials, and different colors.

I. Refinish any work judged defective at no additional cost to the Owner; repair all work damaged during the progress of the construction.

J. Leave finished surfaces clean, completely covered, uniform in appearance, and satisfactory to the Owner.

3.2 SURFACE PREPARATION

A. Dirt, oil, grease, and chemical contamination shall be removed by solvent washing or other suitable means before cleaning of exposed or sealed surfaces.

B. Exposed surfaces shall be cleaned by grit-blasting (no shot blasting) unless otherwise specified or directed by the Owner.

1. Surfaces Exposed to Weather: Surfaces exposed to weather (outside of the building envelope) shall be cleaned per Society for Protective Coatings Surface Preparation Specification No. SSPC SP 10, Near White Blast Cleaning.

2. Surfaces Not Exposed to Weather: Surfaces not exposed to weather (within the building envelope) shall be cleaned per Society for Protective Coatings Surface Preparation Specification No. SSPC SP 6, Commercial Blast Cleaning.

3. The Contractor shall take all precautions (grit size selection and air pressure, etc.) to avoid warping sheet panels.

C. The resulting surface shall have a sharp angular profile with a uniform mottled gray appearance and a surface anchor pattern of at least 1.5 mil but not over 3.0 mil.

D. Prior to grit-blasting, welds shall be given special attention for removal of welding flux in crevices. Welding spatter, slivers, scabs, and underlying mill scale not removed during fabrication and exposed before and during the cleaning operation shall be removed by the best mechanical means. Exposed edges shall be rounded to 3 mm radius (1/8-in.) to assure proper adhesion and coating buildup.

E. The compressed air supply used for grit-blasting shall be free of detrimental amounts of water and oil. Separators and traps of a size and type recommended by the compressor manufacturer shall be provided and these shall be emptied prior to passing water and/or oil into the air stream.

1. Verify that the compressed air is clean by directing a stream of high-pressure air onto a clean white cloth or white blotter paper for 1 minute.

2. Any residue or soiling on the rag is evidence of a contaminated air supply.

3. Clean the air system and retest before commencing grit-blasting.

F. Only dry grit-blasting procedures shall be allowed.

G. The cleaned surface shall be rendered dust free prior to the application of the coating.

H. No acid washes or other cleaning solutions or solvents shall be used on the surfaces after grit-blasting. This includes any inhibitive washes intended to prevent rusting.

I. Grit-blasting and coating operations shall be scheduled so that they will not be in progress at the same time unless there is adequate separation or barriers to avoid entrapped grit or dust in wet paint.

J. The blast-cleaned surface shall be coated with one coat of the specified primer during the same day as blasted, prior to sunset and before any visible rusting occurs.

K. Unprimed blasted surfaces which are wet due to either rain or moisture build-up shall be re-blasted when dry to SSPC SP-10 cleanliness.

L. Outdoor grit-blasting will be permitted only during daylight hours and only when the surfaces will be dry after blasting and before painting.

M. Grit-blasting shall not be permitted when surfaces are less than 3 degrees C above the dew point. The only exception will be for rough initial blasting which will be allowed during the night provided the surfaces are cleaned and brightened the next morning with fresh light grit-blasting to provide SSPC SP-10 near white blast cleanliness.

3.3 APPLICATION

A. Paint Application

1. Paint shall be furnished in the paint supplier’s original unopened and clearly identifiable containers. No mixing of different paints shall be done without the express permission of the Engineer.

2. Paint shall be applied in accordance with the paint supplier’s recommendations and in accordance with the applicable portions of Society for Protective Coating Specification PA 1 "Shop, Field, and Maintenance Painting".

3. Paint shall be thinned only as recommended by the paint manufacturer.

4. Surfaces shall be cleaned, free from dust and dry before and during the paint application.

5. Primer shall be applied from a low RPM continuously agitated pot to prevent settling of zinc component.

6. Excessive film thickness and/or over-application of the exterior MCU organic zinc primer may lead to blisters and/or pinholes, which will require complete removal of the affected areas by abrasive blasting and re-application.

7. No paint shall be applied if the surface temperature is less than 3 degrees C above the dew point or the ambient temperature is less than 5 degrees C.

a. Consult the paint manufacturer’s recommendations for application temperature limitations as they vary between zinc primer and epoxy intermediate.

b. The finish coat shall not be applied if rain is threatening.

8. Paint shall be allowed to dry thoroughly and/or the minimum time specified (based on the relative humidity) by the paint manufacturer shall pass prior to the application of a succeeding coat.

9. The second coat shall be applied after welding has been completed. Surfaces shall be cleaned to remove surface contaminants and moisture not more than 72 hours prior to the application of the second coat. Damage to the first coat shall be repaired before the second coat is applied.

10. Paint shall not be applied within 150 mm of uncleaned surfaces.

11. Exterior and interior surfaces shall receive a minimum of 3 coats. Total thickness of all coats shall be the minimum specified DFT. Interior Element spaces that will be sealed or permanently closed do not need a finish coat of paint but must receive a prime and intermediate coat.

12. Paint supplier’s paint film thickness recommendations shall be strictly adhered to for both minimum and maximum thickness. The film thickness shall be checked with a micro test or other approved calibrated film thickness gauge. Damage to previous coats shall be corrected prior to the application of a succeeding coat.

13. The sequence to be followed in painting shall minimize damage to the finish coat. The intermediate and finish coats shall be applied after welding has been completed. Surfaces shall be cleaned to remove surface contaminants and moisture not more than 72 hours prior to the application of the next coat. Damage to the previous coat shall be repaired before the next coat is applied.

14. Each coat is to be applied uniformly and completely over the entire surface.

15. Faying surfaces of bolted connections shall be masked to prevent application of all but the prime coat.

B. Spray Application

1. Paint shall be spray applied by airless or conventional equipment except where inaccessible and the Owner’s permission has been granted to use brush application.

2. Painting equipment shall be in good working order and shall be subject to the inspection and acceptance of the Owner. Spray lines and pots must be cleaned prior to starting a new application.

3. For conventional spray application the following shall be observed:

   a. A moisture trap, of a type and size recommended by the painting equipment manufacturer, shall be placed between the air supply and the pressure pot. The trap shall continuously bleed off any water or oil from the air supply.

   b. Suitable regulators and gauges shall be provided for the air supply to the pressure pot.

c. Atomizing air shall be regulated to the minimum amount required to properly atomize the material. Spray width adjustment on the gun and readjustment of the atomizing pressure at the regulators shall be performed until the proper spray pattern is found. In the application of the coatings, each spray pass shall overlap the previous spray by 50 percent.

d. Multiple crisscross passes shall be required to achieve the required wet film and dry film thickness.

4. The spray gun shall be held no closer than 150 mm and no farther than 300 mm from the surface to be painted and shall always be held at right angles to the surface. Even parallel passes shall be made with the spray gun; arching will be rejected.

C. Brush Application

1. On exposed surfaces where permission is granted to use brush application sufficient multiple coats shall be applied to achieve the required film thickness.

2. Avoid heavy applications of the paint that will cause mud-cracking, pinholes or other paint defects.

3. Brushes shall be of a style and quality that will enable the proper application. Brush width shall not exceed 125 mm (5 inches).

4. Paint shall be worked into crevices and corners; runs and sags shall be brushed out in order to avoid air pockets, solvent bubbles, and voids.

D. Field Painting

1. Field painting shall consist of touch-up work only. Special attention shall be given to areas where burning or welding has damaged the shop paint. Areas requiring touch-up shall be those scuffed, chipped, burned, or otherwise damaged during shop disassembly, shipping and field erection.

2. Prior to power tool cleaning the surface all contaminants shall be removed including non-visible soluble salts, which shall be removed by pressure washing with potable water.

3. The damaged surfaces shall be cleaned to SSPC SP-11 (Power Tool Cleaning to Bare Steel) leaving a minimum 37-micron (1.5 mil) profile, feathering the edge and overlapping slightly onto the intact coating. Power wire brushing shall not be used unless followed by a process that leaves the proper anchor profile.

4. No paint shall be applied if the surface temperature is less than 3 degrees C above the dew point or the ambient temperature is less than 10 degrees C.

5. Painting of damaged areas may be applied by brush or low nap rollers. Multiple applications shall be required to achieve the required paint thickness. Paint shall be feathered to blend color and shall match without noticeable difference in shade.

3.4 PAINT ADHESION AND THICKNESS VERIFICATION

A. The Owner may make destructive tests of the paint on reasonably small areas to verify adhesion or sufficient thickness of each of the individual coats. The Contractor shall repair

these areas at his expense.

B. Adhesion shall be 2 MPa (300 psi) minimum as measured by a Type III, IV or V tester in accordance with ASTM D 4541, latest edition.

C. The thickness of each individual coat shall be verified by ASTM D 4138 – Test Method for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive Means.

3.5 WARRANTY

A. The coating system shall be provided with a full five (5) year warranty by the Contractor.

1. If the specified coating system does not meet the paint supplier's requirements to be warranted for the full warranty period, the paint supplier shall propose an alternate coating system to the Owner for review.

2. If the Owner does not approve the alternate coating system, the Contractor shall, at no cost to the Owner, provide a coating system from one of the other Approved Manufacturers.

B. The conditions of coating system warranty are as follows:

1. All components coated using the specified paint system, except:

a. Purchased parts and accessories shall maintain the warranty provided by the supplier.

2. Failure is defined as corrosion of substrata in excess of ASTM-D610/SSPC-Vis2 Grade 5 on 1 percent of the total area or 3 percent of an area of 10 sq. meters, except:

a. Corrosion caused by physical and mechanical abuse or damage.

b. Deterioration caused by fire, explosion, welding or other related acts.

C. Contractor shall notify the paint supplier, in writing, giving details of nature of claim immediately and paint supplier shall give prompt attention. Repairs falling within the warranty shall be made following the recommendations of the paint supplier.

END SECTION 050513

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Prefabricated building columns.
3. Grout.

B. Related Sections:

1. Division 01 "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 "Steel Decking" for field installation of welded headed studs through deck.
3. Division 05 "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
4. Division 09 “High Performance Coatings”

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 Preinstallation Conference

A. Conduct conference at Project site.

B. Coordinate attendance of representatives of each entity directly concerned with structural steel framing, including the following:

1. General Contractor’s Superintendent.
2. Steel Fabricator.
3. Steel Erector.
4. Owner or Owner’s Representative.
5. Architect.
6. Structural Engineer.
7. Special Inspector.

C. Review the following:

1. Special inspection and testing procedures.
2. Protocol for field corrections and nonconformance issues.
3. Erection sequence.
4. Construction loading on or adjacent to structure.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs):

1. Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint qualified by testing, including the following:

a. Power source (constant current or constant voltage).
b. Electrode manufacturer and trade name, for demand critical welds.

2. For welds to reinforcing steel, provide according to AWS D1.4/D1.4M “Structural Welding Code – Reinforcing Steel.”

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Welded headed studs.
5. Deformed bar anchors.

6. Shop primers.
7. Nonshrink grout.

F. Source quality-control reports.

G. Certified Manufacturer's Test Reports

1. Charpy V-Notch (CVN) impact test results for the following:

a. Heavy Sections.
b. Filler metal for Demand Critical Welds.

H. Design Calculations: Submit design calculations, bearing the seal and signature of a Professional Engineer, employed by the Contractor and registered in the state of the project, for the following:

1. Connections that differ from that indicated in the contract documents.
2. Requests for substitution of member sizes or material grades.
3. Modification of the strength or configuration of structural framing for the convenience to accommodate the erection sequence, construction equipment, and/or material availability.
4. Calculations shall be in conformance with the reference standards cited herein and shall clearly demonstrate applicability for the intended use.

I. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Certification program and is designated an AISC Certified Plant, Category BU.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel" and WABO (or approved equal) requirements.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 358.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

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

1.9 COORDINATION

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

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.10 REDESIGN

A. Redesign or Departures from Requirements of the Contract Documents Initiated by Contractor:

1. Obtain written acceptance from the Architect and Architect’s consultants.
2. Bear costs for Contractor-initiated or construction error-caused changes to type, form, system, or details of construction from those indicated by the contract documents.
3. Pay fees required by Architect and Architect’s consultants for review of such changes.

1.11 EXCEPTIONS TO AISC CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES

A. Revise Section 7.14, Correction of Errors, as follows:

“The correction of minor misfits by moderate amounts of reaming **or** grinding, ~~**welding or cutting**~~, and the drawing of elements into line with drift pins, shall be considered to be normal erection operations. Errors that cannot be corrected using the foregoing means, or that require ~~**major**~~ **welding, cutting or** changes in member or Connection configuration, shall be promptly reported to the Owner’s Designated Representatives for Design and Construction and the Fabricator by the Erector, to enable the responsible entity to either correct the error or approve the ~~**most efficient and economical**~~ method of correction to be used by others.”

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25percent.

B. W-Shapes: See Structural Drawings.

C. Channels, Angles See Structural Drawings.

D. Plate and Bar: See Structural Drawings.

E. Cold-Formed Hollow Structural Sections: See Structural Drawings.

F. Steel Pipe: See Structural Drawings.

1. Finish: Black except where indicated to be galvanized.

G. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A325 Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325-1, compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A490 Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 490-1, compressible-washer type with plain finish.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A325 Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 3125, Grade F1852 Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc coating.

E. Welded Headed Studs: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Deformed Bar Anchors: ASTM A 1064 (previously ASTM A 496); AWS D1.1/D1.1M, Type C.

G. Welded Threaded Studs: ASTM A 108, Grades 1015 through 1020, threaded-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type A.

H. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

I. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

J. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM F 436, Type 1, hardened carbon steel.
3. Finish: Plain typical. Hot-dip zinc coating where noted, ASTM A 153/A 153M, Class C.

2.3 PRIMER

A. Steel Primer: Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting".

2.4 GROUT

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

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

F. Welded Headed Studs, Welded Threaded Studs and Deformed Bar Anchors: Prepare steel surfaces as recommended by manufacturer of connectors. Use automatic end welding according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 SHOP PRIMING

A. See Painting Specifications Division 09.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize structural steel, connections, etc. where indicated on the drawings.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Light drifting will be permitted to draw the parts together, but drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills, care being taken not to weaken the adjoining metal. If, in the opinion of the Architect, the extent of the reaming is such that holes cannot be properly filled or accurately adjusted after reaming, the faulty member shall be discarded and replaced with a new one, and all costs and expenses resulting shall be paid by the Contactor.

H. No cutting of sections, either flanges, webs, stems or angles, shall be done by the Contractor without the consent of the Architect, unless this cutting is particularly specified or shown on the drawings.

I. Welded Headed Studs, Welded Threaded Studs and Deformed Bar Anchors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding according to AWS D1.1/D1.1M and manufacturer's written instructions.

J. Corrective Measures

1. Any errors in locations or inaccuracies in the setting of anchor bolts, base plates, bearing plates, or other items of attachment or support for steel work shall be reported to the Architect, and shall be corrected in a manner subject to the approval of the Architect.
2. Any misfits due to errors in fabrication shall be reported immediately to the Architect, along with proposed method of correction of same and Architect approval obtained before proceeding with corrective measures.
3. No members shall be cut or burned without specific approval in writing.
4. Bolted or welded connections, joints, or fastenings, which are classified as defective in the opinion of the Architect, shall be corrected by the Contractor in a manner subject to the Architect’s approval.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

C. Erection Connections, etc.: Place holes, plates, or other attachments required by the Erector so as not to interfere with or cause any other detrimental effect to structural members or their connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof deck.

B. Related Requirements:

1. Division 05 "Structural Steel Framing" for shop- and field-welded shear connectors.
2. Division 05 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
3. Division 09 "Exterior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, gauge, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, rib closures, and attachments to other construction. Indicate temporary deck shoring, where required.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Evaluation Reports: ICC-ES or IAPMO-UES report for steel deck.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Keep steel deck off ground on platforms or pallets. Slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI Roof Deck Design Manual Publication No. RDDM, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50G90 zinc coating.
2. Deck Type: Profile, type, gauge and span condition as indicated on the structural drawings.
3. Side Laps: Interlocking seam.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

D. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

E. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

F. Galvanizing Repair Paint: ASTM A 780.

G. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Floor and Rood Deck Design Manuals (FDDM and RDDM), manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members as indicated on the structural drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated on the structural drawings.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:

1. End Joints: Butted.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Remove and replace work that does not comply with specified requirements.

C. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09 Painting Sections.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
4. Floor joist framing.
5. Roof rafter framing.
6. Ceiling joist framing.
7. Soffit framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

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

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing: ClarkDietrich, SCAFCO Corporation, or approved equal.

B. Framing Connections and Accessories: ClarkDietrich, Simpson Strong Tie

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

    a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height.
    b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
    c. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height.
    d. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
    e. Floor Joist Framing: Vertical deflection of 1/360 for live loads and l/240 for total loads of the span.
    f. Roof Rafter Framing: Vertical deflection of 1/120 of the horizontally projected span for live loads.
    g. Ceiling Joist Framing: Vertical deflection of 1/120 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

    a. Upward and downward movement of 1/2 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90).

B. Steel Sheet for [Vertical Deflection] [Drift] Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

2.4 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-3/8 inches.

D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Top Flange Width: 1-1/2 inches.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0329 inch.
b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch.
b. Flange Width: dimension equal to sum of outer deflection track flange width plus 1 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0329 inch
b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch
b. Flange Width: dimension equal to sum of outer deflection track flange width plus 1 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.7 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-5/8 inches minimum.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel joists.
2. Flange Width: 1-1/4 inches, minimum.

2.8 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-5/8 inches, minimum.

2.9 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-5/8 inches, minimum.

2.10 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.11 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.12 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: **ASTM A780/A780M** Retain "Cement Grout" or "Nonmetallic, Nonshrink Grout" Paragraph below if concrete or masonry substrates require leveling before setting track or prefabricated assemblies.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.13 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-

resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Drawings. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.7 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: As indicated on Drawings.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.8 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.9 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Shop Drawings: Show details of fabrication and installation. Stamp stair drawings with Seal of Washington Structural Engineer.

B. Certificates: Welder's certification by WABO.

1.2 QUALITY ASSURANCE

A. Welders qualifications: Certified per WABO Standard 17-13.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural shapes: ASTM A 36

B. Miscellaneous: ASTM A 283

C. Pipe: ASTM A 53

D. Structural tubing: ASTM A 500, grade B; or ASTM A 501

E. Priming paint: Fabricator's standard VOC compliant, lead and chromate free.

F. Perforated Metal: ASTM A 1008.

2.2 FABRICATION

A. Welding: Conform to AWS D1.1. and WABO requirements.

B. Stairs: 100 psf live load. Stringer deflection not to exceed 1/240 of span.

C., Railings: Resist 200 lbs. lateral force without damage or permanent set.

2.3 FINISHING

A. Preparation: Remove rust, scale and material detrimental to finish. Remove burrs from cut edges.

B. Galvanized finish: Hot dip per ASTM A 123.

C. Apply one coat primer to prepared surface according to manufacturer's printed instructions.

D. Finish schedule:

1. Encased in concrete or masonry: (None)

2. Other locations:

Interior: Prime paint

Exterior: Galvanize and prime paint

PART 3 - EXECUTION

(NOT USED)

END OF SECTION 055000

SECTION 057300 DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes:

1. Steel and iron, and stainless steel decorative metal railings

B. Related Requirements:

1. Section 033000 “Cast-In-Place Concrete”.
2. Section 099113 "Painting" for painting of decorative metal railings.

1.03 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied. Comply with paint and coating manufacturer’s written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage 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. Deliver such items to Project site in time installation.

C. 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.

1.04 SUBMITTALS

A. Product Data: For each type of product, include preparation requirements and application instructions.

B. Welders’ Certificates. Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Drawings shall indicate all sizes, connections, fastenings, and accessories. Indicate welded connections using standard AWS A2.4 welding symbols and indicate new weld lengths.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes on exposed surfaces from damage by applying a strippable temporary protective covering before shipping.

1.06 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrication by field measurements before fabrication.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22kN) applied horizontally on an area of 1 square foot (0.093 sq.m).
b. Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg. F (67 deg C), ambient; 180 deg. F (100 deg C), material surfaces.

2.02 MATERIALS 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: Same metal and finish as supported rails unless otherwise indicated.

1. Provide formed-steel brackets with predrilled holes for bolted anchorage.

2.03 STAINLESS STEEL

A. Pipe: ASTM A 312/A 312M: Grade TP 316.

B. Bars and Shapes: ASTM A276, Type 316.

2.04 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. As indicated on drawings.

2.05 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Uncoated and Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
2. Stainless Steel Components: Type 316 stainless steel fasteners. Flathead, countersunk, tamperproof sex bolts.

B. Post-Installed Anchors: Fastener system with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193

2.06 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 “Painting”.

B. Bituminous Paint or Nylon Washers: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M, or 0.010 thick nylon washersTo isolate stainless steel components from carbon steel components.

C. Nonshrink Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.

2.07 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, detail, 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 coordinate 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. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connection 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.

I. Close exposed ends of hollow railing members with prefabricated end fittings.

J. Brackets, Flanges, Fittings, and Anchors: Provide brackets, flanges, miscellaneous fittings and anchors to interconnect railing members to other work unless otherwise indicated.

K. Provide inserts and other anchorage devices for connecting railings to concrete work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.08 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. All welded stainless-steel members to be passivated after welding to restore corrosion resistant properties prior to applying finish treatments.

C. Dull Satin Finish: ASTM A 480/A 480 M, No. 6.

2.09 STEEL AND IRON FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous metal fitting, brackets, fasteners, and sleeves, but galvanize anchors to be embedded into exterior concrete.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Stainless steel components are not to be painted. Comply with requirements of 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.

1. Shop-Painted Finish: Comply with Section 099113 “Painting”.

D. Shop-Painted Finish: Comply with Section 099113 “Painting”.

1. Color: Tnemec “Briquet” 49GR

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark location if not already done.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railing. 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 of 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 1/16th inch in 3 feet (2 mm in 1m).
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 ¼ inch in 12 feet (5 mm in 3 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

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.

3.03 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railings components. Use wood blocks and padding to prevent damage to railing members and fittings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in “Fabrication” Article whether welding is performed in the shop or in the field.

C. 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 one side, and locate joint within 6 inches (150 mm) of post.

3.04 ATTACHING RAILINGS

A. Secure railing to concrete retaining wall with drilled-in expansion shields and hanger or lag bolts.

3.05 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and pain exposed areas with same material 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.

3.06 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing fabricator. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installations 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 057300

SECTION 061000 – ROUGH CARPENTRY

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Blocking, nailers, and curbing.
2. Plywood terminal back boards.

B. Related Sections:

1. 076200 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

A. American Plywood Association (APA)

B. American Society for Testing and Materials (ASTM):

1. E84 - Test Method for Surface Burning Characteristics of Building Materials.

C. American Wood Preservers' Association: Book of Standards (AWPA).

D. National Lumber Grading Authority of Canada (NLGA).

E. Product Standard (PS): PS-20 - American Softwood Lumber Standard.

F. West Coast Lumber Inspection Bureau (WCLB): Standard Grading Rules for West Coast Lumber.

G. Western Wood Products Association (WWPA).

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit complete technical and product data on the following:

1. Fire retardant wood treatments.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Work shall conform to the requirements of the jurisdictional code authorities.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

A. Lumber shall be manufactured in accordance with PS 20 and shall be stamped and graded in accordance with WWPA, WCLB, or NLGA grading rules.

B. Moisture Content: Kiln dried to 19% maximum moisture content, except for material whose least dimension is 4 inches thick or greater.

C. Species: Hem-Fir, Spruce-Pine-Fir (SPF), or Douglas Fir Larch, unless indicated or specified otherwise.

D. Architectural Lumber Grades: Unexposed non-structural wood framing and blocking indicated on the Architectural Drawings shall be graded as follows:

1. Members 2" to 4" thick, 2" to 4" wide: "No 2 - Structural Light Framing," or better; "Stud" grade may be used at stud applications

2. Members 2" to 4" thick, 5" and wider: "No.2 - Structural Joists and Planks," or better (Recommended for most general construction uses)

2.2 PANEL MATERIALS

A. Terminal Backboards: APA AC grade exterior; fire retardant treated.

2.3 ACCESSORIES

A. Fasteners:

1. Hot-dipped galvanized steel or copolymer coated for exterior, high humidity, and treated wood locations.

2. Screws: Self tapping; countersunk or low profile head.

2.4 WOOD TREATMENT

A. Fire Retardant Treatment:

1. All fire retardant treated wood materials shall bear a UL "FR-S" label, or a label from an approved inspection agency certifying that the material meets the requirements of AWPA C-20 Type A for lumber and AWPA C-27 Type A for plywood.

2. Treated lumber shall be kiln dried to a maximum moisture content of 19%; treated plywood shall be kiln dried to a maximum moisture content of 15%.

3. Interior Fireproofing: Clear finish product, Arch Treatment Technologies, Inc "Dricon FRT Wood,"

4. Hoover Treated Wood Products, Inc. "Pyro-guard," or Protim Solignum. "Osmose FirePRO."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 BLOCKING, NAILERS, AND CURBS

A. Provide blocking, nailers, and curbs for roof construction, metal flashing, and other construction as indicated, and as necessary for firm support. Unless otherwise indicated, solid wood backing shall be minimum 2-inch nominal thickness; plywood shall be minimum 3/4 inch thick.

B. Blocking: Install wood blocking to receive mechanical fasteners for support of wall mounted components.

C. Screw fasten wood components to metal framing and support elements.

3.3 PLYWOOD TERMINAL BACKBOARDS

A. Provide a fire retardant treated plywood terminal backboard for telephone systems where indicated on the drawings.

END OF SECTION 061000

SECTION 064023 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim for transparent finish.
2. Shop finishing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

C. Shop Drawings:

1. Include the following:

a. Dimensioned plans, elevations, and sections.
b. Attachment details.

2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
4. Apply AWI Quality Certification or WI Certified Compliance Program label to Shop Drawings.

D. Samples: For each exposed product and for each shop-applied color and finish specified.

1. Size:
   a. Lumber Products: Not less than 5 inches (125 mm) wide by 12 inches (300 mm) long for each species and cut, finished on one side and one edge.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For architectural woodwork manufacturer and Installer.

B. Product Certificates: For the following:
   1. Adhesives.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

   1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program or WI's Certified Compliance Program.
   2. Installer Qualifications: Manufacturer of products

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

   1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.7 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

B. Field Measurements: Where architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for

trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. <Insert, in separate subparagraphs, names of preapproved architectural woodworking firms>.

2.2 WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI or WI certification program indicating that woodwork and installation complies with requirements of grades specified.

2. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Custom.

B. Hardwood Lumber:
1. Species: White oak.
2. Cut: Plain sliced/plain sawn.
3. Wood Moisture Content: 8 to 13percent.
4. For base wider than available lumber, glue for width. Do not use veneered construction.

C. Softwood Lumber:

1. Wood Species and Cut:[Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.]
2. Species: Douglas fir, clear, vertical grain.
3. Cut: Plain sawn.
4. Wood Moisture Content: 8 to 13 percent.
5. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (76 mm) wide.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.5 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:

a. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.

a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.6 SHOP PRIMING

A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

B. Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

1. Back-priming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.7 SHOP FINISHING

A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Custom.
2. Finish System:
   a. 11: Polyurethane, Catalyzed.

3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Staining: Match approved sample for color.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install architectural woodwork to comply with same grade as item to be installed.

B. Assemble architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

G. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program or WI's Certified Compliance Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

3.4 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork.

C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.

1. Fill nail holes with matching filler where exposed.
2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.5 CLEANING

A. Clean interior architectural woodwork on exposed and semi-exposed surfaces.

END OF SECTION 064023

SECTION 064116 - ARCHITECTURAL 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. Plastic-laminate-clad architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 085653 “Bullet Resistant Transaction Window” for transaction tray and window.
3. Section 088000 “Glazing”
4. Section 123661 "Solid Surface Countertops" for solid surface countertops and casework.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

C. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches (200 by 250 mm) for each type, color, pattern, and surface finish required.

a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Thermoset Decorative Panels: 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish.

a. Provide edge banding on one edge.

3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program or WI Certified Compliance Program certificates.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program of WI's Certified Compliance Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) unless noted otherwise.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

1. Reveal Dimension: 1/2 inch (13 mm), or as indicated.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade VGS.
4. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels] [Horizontally for drawer fronts, doors, and fixed panels.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade CLS.
   a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
   b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermoset decorative panels.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Drawer Construction: 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 or glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Manufacturers:
   a. Formica Corporations.
   b. Wilsonart LLC
   c. Or Approve Equal.
2. High Pressure Decorative Laminate (HPDL): NEMA LD 3.
   a. Color: Boardwalk Oak

2.2 WOOD CABINETS FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Custom.

B. Type of Construction: Face frame.

C. Wood for Exposed Surfaces:

1. Species: White Oak.
2. Cut: Plain sliced/plain sawn.
3. Grain Direction: Vertical
4. Finish: Transparent finish, stained to match wood grille ceiling and wall panels.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Architectural Woodwork Standards Grade: Custom.

B. Hardwood Lumber:

1. Wood Species and Cut: White oak, plain sliced/plain sawn.
2. Finish: Transparent finish, stained to match wood grille ceiling and wall panels.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Veneer-Faces Panel Products (Hardwood Plywood): HPVA HP-1.
2. Hardwood Lumber:
   a. Wood Species and Cut: White oak, plain sliced/plain sawn.
   b. Finish: Transparent finish, stained to match wood grille ceiling and wall panels.

2.5 COUNTERTOPS

A. Solid Surface (Public Lobby Reception/Display Case, Break Room, Lactation).

1. See Section 123663 Solid Surface Countertops.

B. Stainless Steel (Evidence Locker, Forensic, In-Custody Sec Vest).

1. Type 304, stainless steel, 16 gauge (0.0625 inch) nominal thickness.
2. Finish: 4B satin brushed finish.
3. Exposed Edge Shape: Straight turndown with return; 1-1/2 inch high face, ½ inch return to face of case, reinforced with hardwood or steel.

2.6 TACKABLE SURFACE (LOBBY CASEWORK)

A. Homogenous tackable surface material made of primarily natural materials consisting of linseed oil, cork, rosin binders and pigment, with natural jute backing.
1. Color: Natural cork color.
2. Thickness: ¼ inch (6 mm)
3. Adhesive: As recommended/approved by manufacturer.

2.7 CABINET HARDWARE AND ACCESSORIES

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality and grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using shelf rests, chrome finish, spacing indicated on drawings.

1. Knape & Vogt 346 Series, or equal.

C. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.

D. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

E. Drawer Slides: ANSI/BHMA A156.9.

1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.

F. Slides for Sliding Glass Doors: ANSI/BHMA A156.9, B07063; aluminum.

G. Door Locks: ANSI/BHMA A156.11, E07121.

H. Drawer Locks: ANSI/BHMA A156.11, E07041.

I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

J. Tempered Float Glass for Cabinet Doors: ASTM C1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, 6 mm thick unless otherwise indicated.

1. Unframed Glass Doors: Seam exposed edges seamed before tempering.

K. Tempered Float Glass for Cabinet Shelves: ASTM C1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.

L. Grommets for Cable Passage: 1-1/4-inch (32-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black.

2.8 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive: Type recommended by fabricator to suit application, not containing formaldehyde or other volatile organic compounds.

2.9 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

D. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual."

1. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic sheet wall paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Experience completing a minimum five projects of similar size, type, and complexity. Workers employed on this Project competent in techniques required by manufacturer for installation indicated.

B. Testing Agency: Acceptable to authorities having jurisdiction and FM Approvals.

C. Surface-Burning Characteristics: Determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction.

D. FM 4880 approved.

E. Meets USDA/FSIS requirements.

F. UL 2818 GREENGUARD GOLD certified.

G. Hazard Analysis Critical Control Point (HACCP) Certified: GLASBORD panels are suitable for use in food and beverage facilities that operate in accordance with a HACCP-based Food Safety Program.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace defective panels and components that fail in materials or workmanship under normal conditions of use within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Exposed fibers.
b. Rust.
c. Rot.
d. Corrosion.
e. Structural surface cracks.
f. Painting or refinishing required with normal pigmentation and UV degradation excepted.

2. Warranty Period - Glass-Fiber-Reinforced Plastic Paneling: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Crane Composites, Inc.; DESIGNS and GLASBORD Series or comparable product by one of the following:

a. Glasteel.
b. Marlite.
c. Newcourt, Inc.
d. Nudo Products, Inc.
e. Parkland Plastics, Inc.

2. Wall materials will comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

4. Nominal Thickness: Not less than 0.075 inch (1.9 mm) for DESIGNS, and .0.09 inch (2.3 mm) for GLASBORD
5. Wall Panel Size: 4 by 8 ft. (1.2 by 2.4 m).
6. Surface Finish: Smooth.
7. Surface Finish (GLASBORD): Embossed pebble texture.
8. Surface Finish (DESIGN): Smooth finish.
9. Color (Pattern):
   a. GLASBORD, 85 White;
   b. DESIGNS, 025BM Brushed Metal

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard PVC for GLASBORD, and Silhouette PVC for DESIGNS designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.

B. Moldings: PVC pattern-matched to panel.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

1. Adhesives will have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Corners: Plumb and straight.
2. Surfaces: Smooth, sound, and uniform.
3. Nails or Screw Fasteners: Countersunk.
4. Joints and Cracks: Filled flush and smooth with adjoining surfaces.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Ensure that all HVAC, electrical, plumbing, and similar work above the ceiling level has been completed.

E. Condition panels by unpacking and placing in installation space before installation in accordance with manufacturer's written recommendations.

F. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.

3.3 INSTALLATION

A. Install plastic paneling in accordance with manufacturer's written instructions.

1. Do all cutting with carbide-tipped saw blades or drill bits, or cut with snips.
2. Install panels plumb, level, square, flat, and in proper alignment.
3. Install panels to be water resistant and washable.
4. Install panels with manufacturer's recommended gap for panel field and corner joints.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

1. Drill oversized fastener holes in panels, 1/8 inch (3.2 mm) greater in diameter than fasteners, and center fasteners in holes.
2. Apply sealant to fastener holes before installing fasteners.

D. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

E. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

H. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mineral wool insulation with separate vapor retarder.
2. Rigid board perimeter foundation insulation.
3. Rigid board above grade wall insulation.

B. Related Sections:

1. 075419 - PVC Thermoplastic Membrane Roofing: Insulation provided as part of the roofing system.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. C272 - Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
2. C518 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by means of the Heat Flow Meter Apparatus.
3. C578 - Rigid, Cellular Polystyrene Thermal Insulation.
4. C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
5. 01621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
6. E84 - Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Make submittals under provisions of Section 013300.

B. Product Data: Submit manufacturer's product data and installation instructions for each type of insulation.

PART 2 - PRODUCTS

2.1 MATERIALS

B. Semi-Rigid Mineral Wool Cavity Insulation:

1. ASTM C612 type IB; CAN/ULC S702-97 type 1 or approved.
2. Thickness: As indicated.
3. Minimum R value of 4.2 per inch

4. Approved Products:
   a. RainBarrier 45 by Thermafiber Wabash, IN.
   b. Cavity Rock MD by Roxul.

C. Exposure Rated Foam Board Insulation: Dow "Thermax Sheathing"; polyisocyanurate; foil facing; IBC approved for exposure without thermal barrier in accordance with NER-681. Provide with manufacturer's recommended tape seal for joints.

2.2 ACCESSORIES

A. Separate Vapor Retarder for Semi-Rigid Insulation: Foil scrim kraft FSK 25; flame spread of 25 or less and a smoke developed of 50 or less when tested in accordance with ASTM E84.

B. Tape: To match foil scrim kraft FSK 25 face of vapor retarder and foil facer of rigid polyisocyanurate board; 2 inch minimum width.

C. Spray Foam Air Seal: Spray Foam Seal: Low expanding polyurethane spray foam; Dow "GreatStuff" or approved.

D. Related Accessories: Provide other accessories, not specifically described, as required for a complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adjacent materials are secure, properly spaced, dry, and ready to receive installation.

B. Verify mechanical and electrical services within spaces to insulated have been installed and tested.

C. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

D. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION - SEMI-RIGID MINERAL WOOL INSULATION

A. Install semi-rigid mineral wool insulation at the locations indicated.

B. Install insulation within spaces without gaps or voids.

C. Trim insulation neatly to fit spaces. Use insulation free of damage.

D. At metal stud framing, insert the insulation edges tightly into the stud channels for

a friction fit. Provide additional supports as necessary to prevent sliding of insulation in the stud cavity.

END OF SECTION 072100

SECTION 072700 - FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide firestopping and smoke seals at—

1. Penetrations of fire-rated floors and walls.
2. Openings between exterior curtain walls and connecting floor assemblies.
3. Expansion joints in fire-rated walls and floors.
4. Penetrations of shaft and stair enclosures.

1.2 RELATED SECTIONS

Section 033000 - Cast-In-Place Concrete

Section 079100 - Sealants

Section 092500 - Gypsum Board Construction

Division 23 and 24 Sections: Mechanical and Electrical Work.

1.3 SUBMITTALS

A. Product data:

1. Manufacturer's published literature showing product characteristics, performance, and limiting criteria.
2. Installation instructions for each type of firestop required for the Project.

B. Certificates:

1. From firestopping manufacturer attesting that applicator has been trained and is approved by manufacturer to install specified firestopping.
2. From firestopping applicator that appropriate firestopping has been applied according to manufacturer's instructions and that the completed installation complies with requirements of IBC and IFC.

1.4 FIRESTOPPING SYSTEM

A. Firestopping system specified is proprietary with 3M Brand Fire Protection Products. Systems of other manufacturer's may be substituted upon approval providing code compliance is met.

B. Systems consistency throughout the building is required. That is; use the same firestopping system and device on every occurrence of a given type of penetration throughout the building.

1.5 QUALITY ASSURANCE

A. Applicator qualifications: Trained and approved by firestopping manufacturer.

B. Mockup: Prepare sample application, in location designated by Construction Manager, of each material proposed for use in the Project. Approved mock-ups may be left in place as part of the finished Project and will constitute the standard for remaining work.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original unopened packaged fully identified with manufacturer's name, trade name and UL label. Store materials off the ground and protected from environmental conditions as required by manufacturer.

1.7 PROJECT CONDITIONS

A. Conform to manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 3M Brand Fire Protection Products, Tel. (206) 889-4033, or approved.

2.2 MATERIALS

A. General:

1. Conform to both flame and temperature ratings as tested by nationally accepted test agencies per ASTM E-814 (UL 1479) fire tests. Conduct the fire test with a minimum positive pressure differential of 0.3 inches of water column.

2. Provide a flame and temperature rating of at least 1 hour but not less than the fire resistance rating of assembly being penetrated, as tested per ASTM E 814.

3. Conform to applicable governing codes.

4. Firestopping materials to be asbestos-free.

5. Materials suited for the firestopping of penetrations made by glass, steel, plastic, and insulated pipe.

B. 3M Brand System materials:

1. 3M Brand Fire Barrier CP 25 N/S No-Sag Caulk.

2. 3M Brand Fire Barrier CP 25 S/L Self-Leveling Caulk.

3. 3M Brand Fire Barrier FS-195 Wrap/Strip.

4. 3M Brand Fire Barrier CS-195 Composite Sheet.

5. 3M Brand Fire Barrier Penetration Sealing Systems PSS7900 Series.

6. 3M Brand Fire Barrier Moldable Putty.

7. Products compatible with the above materials as certified by 3M.

C. Damming materials: Ceramic fiber or mineral wool (safing).

1. Noncombustible matching material used in assembly test to establish required fire resistance rating.

D. Pillows: Use where required to maintain protection of penetrations in existing structure until permanent installations are in place.

PART 3 - PART 3

3.1 PREPARATION

A. Inspect and verify that the surface and condition of the substrates have no defects or errors that would interfere with the installation of the firestopping materials. DO NOT proceed with work until unsatisfactory conditions have been corrected.

B. Clean surfaces and substrates of dirt, oil, loose materials and other foreign materials which may affect the proper bond or installation of the firestops in accordance with manufacturer's approved instructions.

C. Provide primers as required which conform to manufacturer's recommendations for various substrates and conditions.

D. Do not apply firestops to surfaces previously painted or treated with a sealer, curing compound, water repellant or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as necessary to comply with manufacturer's instructions.

E. Mask where necessary to protect adjoining surfaces. Remove excess material and stains on surfaces.

3.2 INSTALLATION

A. Install in strict accordance with manufacturer's printed instructions to provide a flame and temperature rating of at least 1 hour but not less than the fire resistance rating of the assembly being penetrated.

B. Provide anchoring devices, back-up materials, clips, sleeves, supports and other materials used in the qualifying fire test.

C. Install firestops with sufficient pressure to properly fill and seal openings to ensure an effective smokeseal.

D. Tool or trowel exposed surfaces. Remove excess firestop material promptly as work progresses and upon completion.

3.3 FIELD QUALITY CONTROL

A. Notify the Construction Manager if the firestopping systems specified cannot meet the requirements of the specification.

B. Examine firestops to ensure proper installation and full compliance with this specification.

C. Provide access to areas of work until inspection by the applicable Code authorities.

D. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

3.4 CLEANING

A. Work visible upon completion: clean adjacent surfaces in accordance with manufacturer's printed instructions.

B. Remove temporary dams after initial cure of firestops, if visible in the finished work.

C. Correct staining and discoloring on adjacent surfaces.

D. Remove debris and excess materials entirely from site and leave work neat and tidy.

END OF SECTION 072700

SECTION 075419 - PVC THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanically fastened thermoplastic membrane roofing system.
2. Roof insulation and cover board.
3. Roofing system vapor retarder.
4. Gypsum decking at parapet walls.

B. Related Sections:

1. 053100 - Metal Decking: Substrate.
2. 076200 - Sheet Metal Flashing and Trim: Non-coated flashings.

1.2 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.

1.3 PERFORMANCE REQUIREMENTS

A. 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. Performance: Roofing system shall conform to the following:

1. Wind Uplift for Mechanically Anchored Roof System: Factory Mutual1-60.
2. Fire: Minimum Underwriter's Laboratory Class B.
3. Thermal: System shall have a maximum thermal conductance of [C = .033 Btuh], averaged over all surfaces to which it is applied. Use averaged C value, not averaged R value.

D. Roofing membrane system shall be an "Energy Star" roofing system as listed by the Environmental Protection Agency.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: For each type of product and component proposed, including membrane, insulation, fasteners, and accessories.

C. Shop Drawings:

1. Details for base flashings, membrane terminations, and penetration details.
2. Tapered insulation patterns, including slopes, insulation thickness, cricket layouts.
3. Insulation fastening patterns for mechanically anchored roof assembly.
4. Layouts for flexible traffic walkways.

D. Quality Control Submittals:

1. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
2. Guarantee Draft: Concurrent with initial product data submittal, submit a draft of roof warranties.
3. Manufacturer's installation specifications.

E. Contract Closeout Submittals:

1. Maintenance Data: For roofing system to include in maintenance manuals.
2. Warranties: Submit specified warranties.
3. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Source Limitations: Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.

1.6 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.

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. 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. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.7 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.

1.8 WARRANTY

A. Manufacturer's Guarantee: Prior to acceptance of work, furnish manufacturer's written 20 year no dollar limit guarantee executed to the Owner. Guarantee shall include workmanship and materials, and shall cover roofing, flashing, and insulation.

PART 2 - PRODUCTS

2.1 PVC THERMOPLASTIC ROOFING MEMBRANE

A. Basis of Design Roofing System: Products of Sarnafil lnc. are listed as the Basis of Design. Similar and equal products by the following other manufacturers may be used subject to the specified requirements:

1. FiberTite 60 mil
2. Sarnafil Sika Plan Membrane 60 mil
3. Duro-Last 60mil (prefabricated roof kits)

B. Basis of Design Roofing Membrane:

1. Mechanically Anchored Roof Membrane: Sarnafil S327, or approved equal.
2. Adhered base Flashing: Sarnafil G410, or approved equal.

C. Membrane Description: Polyvinyl Chloride (PVC) sheet; uniform thickness; flexible; fabric or scrim reinforced; ASTM D 4434, Type III, fabric reinforced; backing as necessary to adhesive installation at base flash conditions.

D. Thickness: 60 mils nominal thickness.

E. Exposed Face Color: White color Minimum SRI of 78 when tested in accordance with ASTM E1980.

2.2 ACCESSORY MATERIALS

A. General:

1. Accessory materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

2. Liquid-type accessory materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced PVC sheet flashing; same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive for membrane, and bonding adhesive for base flashings.

D. Cut Edge Sealant: Manufacturer's standard caulk to seal cut edges.

E. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

F. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

G. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch (25 mm) wide by 0.05 inch thick, prepunched.

H. Vapor Retarder: 10 mil polyethylene sheet; Sarnavap 10 by Sarnafillnc, or approved.

I. Roof Walkway Pad: Sarnafil Walkway Pad, 600 x 600 mm nonslip walking surface with 75 mm weld tabs at each end. Pathways from access point to equipment are shown on the roof plan.

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 pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, seam cleaners, and other accessories.

2.3 GYPSUM DECKING

A. Gypsum Decking: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thickness; "Dens-Deck Prime" by Georgia-Pacific Corporation or approved.

2.4 ROOF INSULATION AND COVER BOARD

A. Foam Board Insulation - one of the following:

1. Polystyrene Board Insulation: ASTM C 578 Type II, 1.35-lb/cu. ft. minimum density; base thermal calculations on tested LTTR values.

2. Polyisocyanurate Board Insulation: Closed-cell polyisocyanurate foam core with a hydrocarbon blowing agent; integrally laminated to heavy coated glass fiber facers; conform to ASTM C 1289, Type II; FS HH-I-1972/2, Class 1; UL 790 (ASTM E 108) Class A; FM 4450/4470 Class 1 fire rating; base thermal calculations on tested LTTR values.

B. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.

C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thickness; "Dens-Deck Prime" by Georgia-Pacific Corporation or approved.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 CLAD METAL GUTTER

A. Through parapet scupper. Size as detailed. Gauge per manufacturer. Heat weld roof to metal coating.

2.6 INSULATION AND COVER BOARD ACCESSORIES

A. Provide 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. Membrane Adhesive: As recommended by the manufacturer of the membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Carefully examine substrate and adjacent construction and verify that conditions are suitable for installation of the work as indicated and specified. Inspection shall ascertain that:

1. All surfaces to be covered by roofing are properly pitched to drain, suitable for installation of roofing system free from susceptibility to puddling.
2. Work of other trades is complete, including installation of blocking and grounds, vents, drains, curbs, and other projections.
3. Substrate surface is clean and free from lumps, foreign matter, surface spalling or flaking, and excessive amounts of dust.
4. Penetrations through the roof deck are properly configured and are a minimum of 16 inches between their closest edges.
5. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
6. Verify that blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. 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.

C. 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.

3.3 VAPOR RETARDER INSTALLATION

A. Lay down continuous layer of vapor retarder over metal deck substrates and backside of metal framed parapets.

B. At parapet walls install vapor retarder directly over metal framing. Use double stick tape or spray adhesive. Run vapor retarder over parapet framing to connect with backside of insulated metal panels. Wood parapet nailers shall be installed over the vapor retarder.

C. Seal lapped joints with manufacturer's recommended double stick tape.

D. Sequence vapor retarder installation with the installation of construction over to minimize exposure of the vapor retarder during installation.

3.5 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 one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

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.

G. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

H. At Metal Decks: Mechanically or adhesively fasten insulation layers to metal deck in accordance with the manufacturer's recommendations to meet wind up-lift requirements. For mechanical fastening, use fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type to resist uplift pressure at corners, perimeter, and field of roof.

I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

3.6 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

D. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

E. Seams:

1. Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

2. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.

3. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

4. Repair tears, voids, and lapped seams in roofing membrane that does 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.

G. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field splice seam.

H. Install roofing membrane and accessory materials to tie in to existing roofing.

3.7 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 sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Run membrane up and over parapets to form a watertight barrier under copings.

3.8 WALKWAY INSTALLATION

A. Flexible Walkways at Mechanically Anchored Roof: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 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 Owner.

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.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet metal flashing and trim.
2. Requirements for flashing and sheet metal provided in other Sections.

B. Related Sections:

1. 061000 - Rough Carpentry: Wood blocking and nailers.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. A653 - Steel Sheet, Zinc Coated, (Galvanized), or Zinc-Iron Alloy Coated by the Hot Dip Process.
3. A792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. B32 - Solder Metal

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, Sixth Edition 2003.

1.3 SYSTEM DESCRIPTION

A. Provide flashing and trim systems to prevent water leakage to the building interior.

B. Fastening systems shall allow for the thermal movement of the materials without buckling, loosening, and leakage.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Catalog cuts and installation instructions for manufactured products.

C. Shop Drawings: Indicate materials, gages, profiles, jointing patterns, jointing details, fastening methods, and installation details.

D. Samples: Submit samples representative of finish and color of prefinished flashing materials.

1.5 QUALITY ASSURANCE

A. Applicator: Company specializing in sheet metal flashing work with 5 years minimum experience.

B. Unless indicated or specified otherwise, perform work in accordance with the recommendations of SMACNA.

C. FM Global Requirements: Flashing details associated with the roofing system shall meet the requirements of FM Global Loss Prevention Data 1-49 for material thicknesses, fabrication and attachment methods.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation.

C. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.7 GUARANTEE

A. Submit in accordance with Section 017700.

B. Furnish guarantee from the installer of each system that metal flashings will properly shed water to the roof or to the building exterior, under all weather conditions, for a minimum period of two years from the date of Substantial Completion. Leaks due to failure of flashing materials, and due to improper installation shall be promptly repaired at no expense to the Owner, and that watertightness of the repair will be demonstrated to the Owner.

PART 2 - PRODUCTS

2.1 SHEET MATERIALS

A. Prefinished Steel Sheet: ASTM A653 steel sheet with G90 galvanized coating or ASTM A792 steel sheet with AZ60 211uminum/zinc coating; 24 gage unless noted otherwise; factory prefinished with 70 percent resin Kynar 500 or Hylar 5000 coating; standard color to match insulated metal wall panels.

Note: NO uncoated galvanized or zinc finishes to be exposed to weather.

B. Color: Selected from manfacturer's standard range of colors

C. Stainless Steel: ASTM A167; Type 302 or 304.

2.2 ACCESSORIES

A. Aluminum Downspout Boot:

1. Furnish (2) Commercial Tile Adapter (TACO 46-6).
    a. Transition from 4x6 downspout to 6" HOPE piping.

b. Color: RAL 7039 Coating

B. Fasteners:

1. Furnish bonded stainless steel 1neoprene sealing washers for exposed applications.
2. Finish exposed fasteners to match material being fastened.
3. Material:
   a. Galvanized Steel Sheet: Use galvanized steel or stainless steel.
   b. Stainless Steel: Stainless Steel.
4. Use screws when fastening into wood or sheet metal.

C. Sealants:

1. Butyl Rubber Type - One of the Following:
   a. "Butyl Sealant" by Tremco, Inc. Sealant/Weatherproofing Division; Beachwood, OH; 800-321-7906; 216-292-5000)
   b. "BP-400" by Adco Global, Inc. (800-248-4010).
2. Polyurethane Sealant - One of the Following:
   a. "Chem-Calk 900" by Bostik Construction Products (Huntington Valley, PA; 800-221-8726; 215-674-5600).
   b. "Dynatroll" by Pecora Corp. (Harleysville, PA; 800-664-7903; 215-799-7528).
   c. "Sonolastic NP I" by SonnebornlChemRex (Shakopee, MN; 800-433-9517; 952-496-6000).

2.3 FABRICATION

A. General Requirements:

1. Field measure site conditions prior to fabricating work.
2. Form sections true to shape, accurate in size, square, and free from distortion or defects.
3. Fabricate cleats and starter strips of same material as sheet; interlockable with sheet.
4. Form pieces in longest practical lengths, except as limited by expansion joint requirements.
5. Non-Moving Joints: Shop fabricate to the greatest practical extent.
   a. Solder all non-moving shop fabricated joints in steel in a stainless-steel flashing.
   b. Prefinished Galvanized Steel: Lap joints 1 inch, minimum; accurately cut and fit as necessary to maintain profile; embed contact surfaces in sealant; rivet with stainless steel or color matched coated steel pop rivets at 3 to 4 inches o.c.
6. Hem exposed edges on underside 1/2 inch; miter and seam corners.

7. Shop fabricate corner sections with non-moving corner joints and 18-inch-long legs.
8. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
9. Form seams lapped in the direction of water flow.

B. Fabricate all flashing to detail, in accordance with referenced SMACNA Architectural Sheet Metal Manual details, and as specified below. Use minimum 24 gage prefinished steel sheet unless indicated or specified otherwise.

1. Parapet Caps (Copings): Fabricate with slotted holes at 24 inches on center for fastening at the back; joints per Table 3-1 and as indicated on the Drawings.
2. Scuppers: 20 gage stainless steel sheet; soldered joints.
3. Conductor Heads: Figure 1-25F.
4. Downspouts: Prefinished steel sheet; SMACNA Figure 1-32; 2" x 3" rectangular (Figure 1-32B), unless indicated otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 INSTALLATION

A. Coordinate and sequence flashing installation with the work of other Sections. Furnish flashing for installation as a part of the work of other Sections.

B. Install starter and edge strips, and continuous cleats before starting installation.

C. Fastening:

1. Secure flashings using continuous cleats whenever possible. Use exposed fasteners only at the backside of copings, and at other locations not exposed to public view, unless otherwise approved by the Architect.
2. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Joints:

1. Install metal flashings with provision for plus or minus 1/16 inch thermal movement

at each end; provide expansion joints at 12'-0" o.c., maximum.

2. Seal concealed lap joints in with two parallel beads of butyl sealant; use butyl sealant where bedding sealant is indicated or required.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleaning and preparation of joint surfaces.
2. Sealant and backing materials.
3. Pre-compressed foam seal to receive sealant over at precast concrete panel joints.

B. Related Sections:

1. 076200 - Sheet Metal Flashing and Trim: Sealants provided as part of flashing and sheet metal work.
2. 088000 - Glazing: Glazing sealants.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. C1193 - Guide for Use of Joint Sealants.

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit for each sealant and compressible foam seal material used. Include manufacturer's surface preparation, priming, and installation instructions for each proposed sealant.

C. Samples:

1. Submit color samples of each sealant type and color proposed for the work.
2. For each sealant type indicated for "color as selected," or for which no color is indicated, submit color card indicating available colors from manufacturer's complete line of pre-formulated colors for each type of sealant. .
3. For custom colors, request color selection from the Architect prior to sample submittal.

D. Quality Control Submittals:

1. Schedule of sealant types, colors and respective locations.

1.4 QUALITY ASSURANCE

A. Installers: Use only skilled workers specially trained in the techniques of sealing, and familiar with the published recommendations of the manufacturers of the sealants being used.

B. Verify that sealants are compatible and non-staining with the substrates and accessory materials provided under other Sections. Send examples of adjacent materials to the sealant manufacturer for compatibility and staining testing. Notify Architect of evidence of incompatibility or staining.

1.5 ENVIRONMENTAL CONDITIONS

A. Unless recommended otherwise by the manufacturer, install sealant systems as follows:

1. Do not apply sealant when ambient temperatures are below 40 degrees F, or expected to fall below 40 degrees F before sealant cure is complete.
2. Do not apply sealant to substrates or accessories that are moist.

PART 2 - PRODUCTS

2.1 SEALANTS

A. Type S - Neutral Cure Silicone Sealants:

1. Dow Corning, 790 Silicone Building Sealant, 791 Silicone Weatherproofing Sealant, or "795 Silicone Structural Glazing and Weatherproofing Sealant."
2. Pecora "890 Architectural Silicone Sealant."
3. Spectrem 3 by Tremco Incorporated.

B. Type PT: ASTM C920, Type M, Grade P, class 25; Tremco "THC 900", BASF Sonneborn "Sonolastic SL 2", Pecora "Urexpan NR~200", or approved; standard colors as selected.

C. Type A: ASTM C834; Tremco "Acrylic Latex Caulk," Pecora "AC-20," Sonneborn/ChemRex "Sonolac," or approved; standard colors to match adjacent construction.

2.2 PRECOMPRESSED FOAM SEAL

A. Pre-compressed prefaced self-adhesive open cell polyurethane foam seal. One of the following:

1. "Backerseal" by Emseal Joint Systems, Ltd.
2. "Sealtite B" by Shul lnternational Company, Inc.

2.3 ACCESSORY MATERIALS

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Backer Rod: Closed or open cell foam as recommended by the sealant manufacturer for the application; round profile; thickness approximately 130 percent of joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

C. Verify joint dimensions and conditions are acceptable to receive the work of this Section.

3.2 PREPARATION

A. Clean and prepare joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.

B. Apply masking tightly around joints to protect adjacent surfaces from excess sealant.

C. Prime as required for proper bond to substrate materials.

D. Backing Materials:

1. Place backer rod to achieve proper sealant Width/depth ratios and to prevent sealant sag.
2. Use bond breaker where there is insufficient depth to use joint filler.
3. Provide pre-compressed foam seal as specified below at exterior precast concrete joints.

3.3 PRE-COMPRESSED FOAM SEAL

A. Install in accordance with manufacturer’s recommendations.

B. Install sufficiently deep to accommodate the installation of the S sealant over.

3.4 SEALANT INSTALLATION

A. Perform work in accordance with ASTM C1193, unless specified otherwise or recommended otherwise by the sealant manufacturer.

B. Apply sealant within recommended temperature ranges.

C. Joint Profile:

1. Sealant beads shall have a sectional width to depth ratio of 2 to 1, unless specified otherwise or recommended otherwise by the sealant manufacturer.

D. Tooling:

1. Tool joints concave, unless indicated or specified otherwise. Finish to uniform profile and depth, free of air pockets, embedded matter, ridges, and sags.

3.5 CLEANUP

A. Clean adjacent surfaces free of excess sealant as the work progresses. Use cleaning agents recommended by the sealant manufacturer.

B. Upon completion, remove and dispose of masking.

3.6 PROTECTION

A. Protect sealant in joints subject to dirt, moisture, and traffic during the sealant curing process. Protection shall be able to resist traffic while remaining securely in position.

3.7 SCHEDULE

A. Type S:

1. Provide type S sealant at all exterior joints not sealed as a part of the work of other sections.

2. Provide colors as selected from manufacturer's complete line for each type of sealant.

3. Provide type S sealant over pre-compressed foam seal at exterior precast concrete joints

B. Type PT:

1. Provide at all interior horizontal slab joints subject to traffic and abrasion, unless specified otherwise; standard grey color as selected.

2. Horizontal Precast Concrete and Steel Trench Lid Joints:

a. Provide sealant at horizontal precast concrete and steel trench lid joints, including joints between lids and joints between lids and adjacent trench edges.

b. Sealed joints are used to keep out dirt and debris. Sealant will be cut away when the lids are required to be lifted.

C. Type A: Provide at all interior joints, unless specified otherwise.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 081416 "Flush Wood Doors" for solid core wood doors.
2. Section 083463 "Detention Doors and Frames" for hollow-metal doors and frames for holding facilities.
3. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
4. Section 088000 "Glazing" for door vision lights.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualification: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an ASSA Abloy Group Company.
2. Steelcraft, an Allegion brand.
3. Or Approved Equal.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements: galvannealed steel complying with ASTM A653/A653M, cod-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying withASTM A1011/1011M, commercial steel (CS) Type B, for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than U-0.37 when tested according to ASTM C518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
d. Edge Construction: Model 1, Full Flush.
e. Core: Manufacturer's standard.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
b. Construction: Full profile welded.

3. Exposed Finish: Factory primed and field finished.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B..

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm), with minimum A60 (ZF180) coating.
d. Edge Construction: Model 1, Full Flush.
e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
f. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
g. Core: Polyurethane with vertical stiffeners.

2. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
   b. Construction: Full profile welded.

3. Exposed Finish: Factory prime and field finish.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.6 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.
4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.

B. Related Requirements:
1. Section 087100 "Door Hardware" for hardware items.
2. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Requirements for veneer matching.
5. Doors to be factory finished and application requirements.

C. Samples for Initial Selection: For factory-finished doors.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.8 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:

1. VT Industries, Inc; Heritage Collection: www.vtindustries.com/#sle.
2. Oregon Door; Architectural Series: www.oregondoor.com/#sle.
3. Or Approved Equal.

2.2 FLUSH WOOD DOORS, GENERAL

A. Doors: See drawings for locations and additional requirements.

1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI's "Architectural Woodwork Standards" , unless noted otherwise
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at each location.
2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C – Positive Pressure; UL or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

2.3 DOOR AND PANEL CORES

A. Non-Rated Solid Core: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.4 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Grade A plain sliced white oak, veneer grade in accordance with quality standard indicated, balanced match between veneer leaves, center balance match of splice veneer leaves assembled on door.

1. Vertical Edges: Same species as face veneer.
2. "Running Match" each pair of doors and doors in close proximity to each other.
3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.5 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

1. Provide solid blocks at lock edge for hardware reinforcement.
2. Stiles and rails bonded to core, then entire unit is abrasive planed before veneering.
3. Faces bonded to core using hot press.

C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.

D. Glazed Openings: Non-removeable stops on non-secure side; sizes and configurations as indicated on drawings.

E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

2.6 FINISHES

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 – Finishing for grade specified and as follows:

1. Transparent:
   a. System – 12, Polyurethane, water-based.
   b. Stain: Match Architect's sample
   c. Sheen: Satin

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.7 ACCESSORIES

A. Hollow Metal Door Frames: See Section 081113 Hollow Metal Doors and Frames.

B. Glazed Openings:

1. Heat-Strengthened and Fully Tempered: ASTM C1048.
2. Glazing: Single vision units, ¼ inch thick glass.
3. Tint: Clear.

C. Glazing Stops

1. Wood, of same species as door facing, butt corners.
2. Profile: To match VT Industries' VT1 (100).
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
4. Door Hardware: See Section 087100 Door Hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

    a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

    a. Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors.
    b. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    c. Where threshold is shown or scheduled, provide1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
    d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083050 – ACCESS DOORS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Door list: Show doors, location, construction of surround, optional features provided.

B. Installation instructions showing details and anchorage.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Wall access door: MILCOR Product Number 3206, or approved.

Size: 12 x 12-inches unless otherwise shown.

B. Ceiling access door: MILCOR Product Number 3210.

Size: 12 x 12-inches unless otherwise shown.

C. Lock: Self-latching, screw driver operated latch release, except provide flush key operated cylinder lock where shown on Drawings. Provide interior latch release.

D. Finish: Manufacturer's standard gray, baked-on primer, except provide stainless steel wall access doors where shown.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Adjust door and hardware to operate properly.

END OF SECTION 083050

SECTION 083310 OVERHEAD COILING METAL DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install overhead coiling doors.

1. Exterior Doors.
2. Interior Doors, heavy duty.
3. Interior Fire Doors

1.2 RELATED SECTIONS

Division 1

1.3 SUBMITTALS

A. General: Where applicable, relate Submittals to Drawing and Specifications with labels showing door type, door number, and frame detail numbers shown on Contract Drawings.

B. Product data: Showing conformance to specification.

C. Shop Drawings showing—

1. Details of door construction including all components.
2. Details of installation and coordination with connection work.
3. Wiring diagrams for operators and controls, and fire/smoke link.

D. Installation instructions.

E. Operating and maintenance data.

1.4 QUALITY ASSURANCE

A. Installer qualifications: Factory authorized.

1.5 MAINTENANCE

A. Spare parts: Submit spare parts list for each type of door. Include ordering data and prices (current as of completion date).

B. Spare parts availability/delivery: Maintain factory stock, all parts. Deliver spare parts to building, or to Owner's Door Service Contractor at location specified, within 24 hours of order placement. Submit evidence that 24-hour parts delivery service has been available for at least 3 years previously, provide list of customers.

C. Operating and maintenance data: Comply with related Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Coiling doors and components of the following manufacturer are the basis of design and specification.

1. R&S Manufacturing, Inc.
Northwest Division
Tel. (503) 777-6370
Tel. (800) 359-4197

B. Substitution: Permitted, comply with related Section.

2.2 COILING DOORS

A. Exterior Door: R&S Rolling Door Products "THERMAL GUARD" insulated door

1. Size: As scheduled.

2. Mounting: Interior.

3. Operation; Geared motor, Model MG [provide counter].

4. Emergency operation: Chain.

5. Fire rating: None.

6. Jamb type: As detailed.

7. Slat type: 25, insulated.

Face: 18-gage galvanized steel, minimum.
Back: 24-gage galvanized steel.
Insulation: Polyurethane foam

8. Finish: Curtain—

Phosphate treat
Prime 2 mils
Finish coat: _____

9. Weatherstrip: Vinyl, both faces
Hood baffle: Neoprene

10. Wind load requirements: 90 MPH, door to be fully operable at 50 mph.]

B. Interior door: R&S Rolling Door Products Heavy Duty Service Door.

1. Size: As scheduled.

2. Operation: Geared Motor, Model MG. Provide counter.

3. Emergency Operation: Chain.

4. Jamb type: As detailed.

5. Slat type: No. 25, galvanized steel, 22-gage minimum.

6. Finish: Curtain

Phosphate treat
Prime 2 mils
Finish coat: _____

[C. Interior Fire Door: R&S Fire Door

1. Size: As scheduled.

2. Operation: chain.

3. Fire rating: 3 hour, UL label; or oversize certificate.

4. Jamb type: As detailed.

5. Slat type: 25

6. Finish: Curtain—

Phosphate treat
Prime: 2 mils
Finish coat: _____

7. Fire/smoke link: "Type McCabe Link" Model E-5762BH.]

2.3 ACCESSORIES

A. Hood—

1. Material: 24-gauge galvanized steel.

B. Electric operator: UL approved, in accordance with ANSI/UL 325, 480-volt, three-phase, 60 Hz supply to electric motor. Equipment with adjustable friction clutch and double shoe brake system actuated by independent full line voltage solenoid controlled by motor starter. Provide fully enclosed positive gear-drive limit switch with magnetic cross line reversing starter.

C. Electric operator controls:

1. Keyed control station: Recessed-mounted three-button (open-close-stop) control for each operator: 24-volt circuit. Include constant-pressure close button.

2. Safety device: Locate full-width, pneumatic type at door bottom. Wire to reverse door upon striking object.

D. Cycle counter: Where shown, provide door operator with non-resettable counter to record cycles. Record each open /close as one cycle. Counter to indicate zero at time of acceptance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings are correctly prepared and other connecting work is in place, ready to receive doors. Do no work until deficiencies are corrected.

1. Verify opening size, dimensions, and tolerances.

3.2 INSTALLATION

A. Install coiling doors in accordance with accepted Shop Drawings and Instructions.

3.3 DEMONSTRATION

A. After all coiling doors are installed, demonstrate operation of each door, including controls and safety features to Construction manager. Notify Construction manager 24 hours in advance of desired demonstration time.

END OF SECTION083310

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For access doors and frames.

1.3 QUALITY ASSURANCE

A. Number, locations and sizes of panels shown on the drawings are approximate. Coordinate with the mechanical subcontractor and submit drawings verifying locations and sizes of access panels. Indicate thickness and door material.

B. Size Variations: Obtain the Engineer's approval of the manufacturer's standard-size units which may vary slightly from the sizes noted

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. General: Provide an access panel assembly manufactured as an integral unit, complete with all parts and ready for installation. Provide the manufacturer's standard insulated, flush panel door with continuous piano hinge and self-closing mechanism.

B. Locking Devices: Provide one cylinder lock per access door. Match existing Snohomish County. Access panels located in chases and away from public spaces do not require locks.

C. Flush Access Doors with Exposed Flanges:
1. Description: Face of door flush with frame, with 1-inch exposed flange and concealed, removable, spring button hinge.
2. Locations: Walls and Ceilings
3. Size: 24-inch x 24 inch
4. Steel Sheet:
   a. Door Material: Nominal 0.062 inch (1.6 mm) 16 gauge. Fold on all four sides for structural rigidity.
   b. Frame Material: Nominal 0.062 inch 16 gauge.

c. Finish: Paintable white.
d. Locations: GWB walls and ceilings

5. Stainless Steel Sheet:
   a. Door Material: Nominal 0.063 inch, 16 gauge.
   b. Frame Material: Nominal 0.063 inch, 16 gauge.
   c. Finish: Type 304 stainless steel, No. 4 finish
   d. Locations: Tile wall surfaces.
6. Hinges: Concealed spring, button type, to allow door removal.
7. Latch and Lock:
   a. Ceiling Access Doors
      1) Cam latch, screwdriver operated.
   b. Wall Access Doors
      1) Latch bolt, key operated. Keyed to match existing County maintenance keys.

PART 3 - \EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulated service doors.

B. Related Requirements:

   1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

   1. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Overhead Door Corporation, 2501 S, State Hwy. 121, Suite 200, Lewisville, TX 75067. 800 275-3290, www.overheaddorr.com

B. Cookson, 1901 S Litchfield Road, Goodyear AZ, 85338, 855 719-4040, www.cooksondoor.com

C. Or Approved Equal.

2.2 INSULATED ROLLING SERVICE DOOR

A. Stormlite Insulated Rolliing Service Door: Overhead Door Corporation Model 625.
1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
a. Flat profile type F-265i for doors up to 40 feet (12.19 m) wide**.**
b. Front slat fabricated of:
1) 18 gauge galvanized steel.
c. Back slat fabricated of:
1) 22 gauge galvanized steel.
d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.

1) R-Value: 7.7, U-Value: 0.13.

2. Performance:
   a. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
   b. Air Infiltration: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft2.
3. Slats and Hood Finish:
   a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
      1) Polyester Top Coat.
4. Weatherseals:
   a. Vinyl bottom seal, exterior guide and internal hood seals.
   b. Interior guide weatherseal.
   c. Lintel weatherseal.
   d. Air Infiltration Package, IECC 2012/2015 listed; product to meet C402.4.3 2012 Air leakage <1.00 cfm/ft2.
      1) Air infiltration perimeter seal package includes: guide cover, guide cap, dual brush exterior guide seal, 4 inch finned lintel brush seal and vinyl bottom seal.
5. Bottom Bar:
   a. Two prime painted steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.

6. Guides: Three structural steel angles.

7. Brackets:
   a. Hot rolled prime painted steel to support counterbalance, curtain and hood.
8. Finish; Bottom Bar, Guides, Headplate and Brackets.
   a. PowderGuard Premium powder coat color as selected by the Architect.
9. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
10. Hood: Provide with internal hood baffle weatherseal.
    a. 24 gauge galvanized steel with intermediate supports as required.
11. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
    a. Sensing Edge Protection.
       1) Pneumatic sensing edge.
    b. Operator Controls:
       1) Controls for both interior and exterior location.
    c. Motor Voltage: 115/230 single phase, 60 Hz.
12. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
13. Locking:
    a. Cylinder lock for electric operation with interlock switch.
14. Wall Mounting Condition:
    a. Face of wall mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

C. Power-Operated Doors: Install according to UL 325.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Storefront framing.
2. Manual-swing entrance doors.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing joints between frames and adjacent construction.
2. Section 087100 "Door Hardware" for hardware items other than specified in this section.
3. Section 088000 “Glazing” for glass and glazing accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

    a. Joinery, including concealed welds.
    b. Anchorage.
    c. Expansion provisions.
    d. Glazing.
    e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer’s Qualification Statement.

C. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

D. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

E. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Washington.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
   1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
      a. Insulated Glass Certification Council (IGCC).

C. Installer Qualifications: An entity that employs installers and supervisors who specialize in performing work of type specified and with at least three years of documented experience.

   1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.
      a. North American Contractor Certification (NACC) for glazing contractors.
      b. Equivalent independent third-party ANSI accredited certification.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.8 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.9 WARRANTY

A. Correct defective Work within a one-year period after Date of Substantial Completion.

B. Provide five (5) year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN – FRAMING FOR INSULATING GLAZING

A. Location:

1. Exterior multi-pane storefront wall assembly.

B. Center-Set Style, Thermally Broken:

1. Basis of Design: Kawneer North America. Trifab 451T
   a. Or Approved Equal

2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

2.2 BASIS OF DESIGN – FRAMING FOR NONINSULATING GLAZING

A. Location:

1. Interior Storefront at Vestibule 15C2A

B. Center-Set Style:

1. Basis of Design: Kawneer North America Trifab 451
   a. Or Approved Equal
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

2.3 BASIS OF DESIGN – SWINGING DOORS

A. Wide Stile, Insulating Glazing, Thermally-Broken:

1. Basis of Design; Kawneer North America, Insulpour 500 Thermal Entrance
   a. Or Approved Equal.

B. Wide Stile, Noninsulating Glazing:

1. Basis of Design: Kawneer North America, 500 Standard Entrance

2.4 ALUMIINUM-FRAMED STOREFRONT

A. Aluminum-Framed Exterior Storefront: Factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Location: Exterior storefront system at exterior walls.
2. Glazing Rabbet: For 1 inch insulating glazing.
3. Finish: Class 1 Dark Bronze AA-M10C21A44.
   a. Factory finish all surfaces that will be exposed in completed assemblies.

b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channels, and migrating moisture occurring within the system.
7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimum space between framing members and adjacent construction while allowing expected movement.
10. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

B. Aluminum-Framed Interior Storefront: Factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Location: Interior storefront system at Vestibule 15C2A
2. Glazing Rabbet: for ¼ inch monolithic glazing.
3. Finish: Class II Dark Bronze AA-M10C21A44.
   a. Factory finish all surfaces that will be exposed in completed assemblies.
   b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimum space between framing members and adjacent construction while allowing expected movement.

C. Performance Requirements

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.

a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

2. Water Penetration Resistance on Manufactured Assembly; No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.
4. Overall U-value including glazing: 0.38 Btu(hr sq ft deg F), maximum.

D. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.5 COMPONENTS

A. Aluminum Framing Members – Exterior Frames: Tubular aluminum sections, thermally broken with interior sections insulated from exterior, drainage holes and internal weep drainage system.
1. Glazing Stops: Flush.

B. Aluminum Framing Members – Interior Frames: Tubular aluminum sections.

1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.

C. Glazing: See Section 088000 Glazing.

D. Swing Doors: Glazed Aluminum.

1. Thickness: 2-1/4 inches.
2. Top Rail: 5 inches wide.
3. Vertical Stiles: 5 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Beveled
6. Finish: Same as storefront.

2.6 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M)

B. Fasteners: Stainless Steel.

C. Exposed Flashing: Aluminum sheet steel, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.

D. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing materials.

E. Sealant for Setting Threshold: Non-curing butyl type.

F. Glazing Gasket: Type to suit application to achieve weather, moisture, and air infiltration requirements.

G. Glazing Accessories: See Section 088000 Glazing.

2.7 FINISHES

A. Class I Dark Bronze Anodized Finish: AAMA 611 AA-M10C22A44 Dark Bronze anodic coating not less than 0.7 mils thick.

B. Class II Dark Bronze Anodized Finish: AAMA 611 AA-M10C22A34 Dark Bronze anodic coating not less than 0.4 mils thick.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.8 HARDWARE

A. For each exterior door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: See Section 087100 Door Hardware.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all exterior doors.

D. Sill Sweep Strips; Resilient seal type, retracting, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.

3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).

c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.5 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

a. Perform a minimum of two tests in representative area.
b. Perform tests in each test area prior to 10 and 70 percent completion.

2. Air Infiltration: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

a. Perform a minimum of two tests in representative area.

B. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

END OF SECTION 084113

SECTION 08 56 53 – BULLET RESISTANT TRANSACTION WINDOW

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 REFERENCES

A. Underwriters Laboratory UL 752-Standard for Bullet Resisting Equipment.

B. ASTM E 119-98 – Standard Test Methods for Fire Tests of Building Construction and Materials.

C. ASTM B 209/B 209M - Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

D. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar.

1.3 SUMMARY

A. Section Includes:

1. Bullet Resistant Transaction Window.
2. Bullet Resistant Deal Tray – Counter-Mount Non-Ricochet.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, attachment to other work.

C. Samples: For each exposed finish.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance with requirements.

B. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Cleaning instructions.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect windows and accessories in accordance with AAMA CW-10 "Care and Handling of Architectural Aluminum from Shop to Site" until Substantial Completion.

B. Deliver materials to the project site with the manufacturer's UL Listed Labels intact and legible. Handle the materials with care to prevent damage. Store materials inside and under cover, stack flat and off floor. Project conditions (temperature, humidity, and ventilation) shall be within the maximum limit recommendations provided by manufacturer. Do not install products stored in conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Workmanship Warranty: All materials shall be warranted against defects for a period of 1 year for the date of receipt at the project site, Provide certificates of manufacturer's standard warranty with closeout documents.

B. Finish Warranty: Manufacturer's warranty against deterioration of factory finishes for a period of 5 years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis of Design:

1. Subject to compliance with requirements, provide products by the following:

a. Total Security Solutions, Inc., 935 Garden Lane, Fowlerville, MI 48836, 866 734-6277. www.tssbulletproof.com

B. Armortex 9926 Corridor Parkway, Schertz, TX 78154, 800 880-8360, www.armotex.com

1. Aluminum Baffle Frame Bullet Resistant Window

2.2 PERFORMANCE REQUIREMENTS

A. Design Performance: Through the design, manufacturing techniques and material application, the TSS Natural Voice Rail Transaction Window shall be of the non-ricochet type. This design is intended to permit the capture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.

1. The assembly shall shall provide single transaction position utilizing the "natural voice" baffle configuration. The design shall employ offset vertical standing vision panels and 5

inch baffles to complete the “natural voice” design as well as to protect against angled ballistic penetrations,
2. Each transaction position to have a non-ricochet stainless-steel dip tray.
3. All vision panels shall be cut to size with all exposed edges polished.
4. Stainless steel assembly screws and acrylic spacers shall be included.

B. Anchor screws as required to install equipment to be provided by installer.

C. Field alterations to the construction of the assembly fabricated under the acceptable standards are not allowed unless approved in writing by the manufacturer and Architect.

D. Standard manufacturing tolerances +/- 1/16 inch shall be maintained.

E. Materials shall meet or exceed UL 752 requirements.

2.3 BULLET RESISTANT NATURAL VOICE BAFFLE TRANSACTION WINDOW

A. Ballistic Resistant: Level 3 in accordance with UL 752 – Testing for Ballistic Resistance for the complete assembly including framing, glazing and panels.

2.4 FABRICATION

A. Aluminum sections to be manufactured in accordance with ASTM B209, Extruded aluminum alloy 6063 T5 Anodized to match the existing décor and be free of sharp edges or burrs when in place.

B. Glazing Channel: U-Channel specifically designed for securing transparencies tightly in place. Angles and stops are only acceptable for top attachment. All exposed aluminum edges shall be clean cut and have no burrs. Exposed corners shall be rounded and sanded.

C. Tolerances: All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members.

2.5 FRAMING FINISH

A. Factory-applied Finish

1. Color Anodic Finish: Architectural Class I, color coating AA-M10C22A42/A44 Mechanical Finish Chemical Finish: etched, medium matte; 0.70 mils minimum complying with AAMA 611 "Voluntary Specification for Anodized Architectural Aluminum"
2. Color: Dark Bronze.
3. Cap the bottom of glazing with the corresponding finish material selected for frame.

2.6 GLAZING

A. Bullet Resistant Level 3

1. 1 ¼ inch TSS-03 L/S Glass Clad

B. Acrylic: All acrylic pieces shall meet or exceed UL 752 testing for ballistic integrity. All edges of acrylic shall be filed, sanded after cutting to remove rough edges and then polished until "water clear" transparent. All through holes for fasteners shall be 3/8" in diameter and be drilled clean. Chipped edges al through-hole exit points are not acceptable. All acrylic pieces shall be supported in the proper glazing channel designed for this purpose.

C. Glazing Gaskets: Closed cell neoprene.

2.7 FRAME

A. Frame to be anodized aluminum.

B. The bottom of the glazing shall be capped with corresponding material on the frame,

2.8 ACCESSORIES

A. Anchors: Fully concealed manufacturer recommended.

B. Mounting plates and connecting clips shall be fabricated from 1/8 inch thick clear polycarbonate.

C. Cash Tray:

1. Location: Recessed.
2. Finish: Brushed Stainless Steel #4 finish.
3. Material: 18 gauge stainless steel.
4. Tray Size: 16 inches X 10 inches X 2 ½ inches tall
5. Bullet Resistance:

    a. Tray shall include a bullet trap enclosure to meet UL ballistics requirements as indicated.
    b. Level 3 in accordance with UL 752 – Testing for Ballistic Resistance for the complete assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Install in accordance with manufacturer’s instructions and UL 752.

C. Install components plumb and true in alignment with established lines and grades.

END OF SECTION 084113

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Work under this section includes the complete finish hardware requirements for the project. Quantities listed are for the contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished, matching the items specified in quality and finish.

B. Related Sections:

1. Section 081100 Hollow Metal Doors and Frames
2. Section 081400 Wood Doors
3. Section 084113 Aluminum Entrances and Storefronts

1.2 QUALITY ASSURANCE

A. Product Qualification:

1. To assure a uniform high quality of materials for the project, it is intended that only specified items be furnished. Comparable products may be accepted upon prior approval of architect.
2. Hardware to be new, free of defects, blemishes and excessive play. Obtain each kind of hardware (Mechanical latch and locksets, exit devices, hinges and closers) from one manufacturer except where specified.
3. Fire-Rated opening in compliance with NFPA80. Hardware UL10C/UBC-7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved bearing hinges and smoke seal. Furnish openings complete.

B. Supplier Qualifications:

1. Hardware supplier will be a direct factory contract supplier who employs a certified Architectural Hardware Consultant (AHC) available at all reasonable times during the course of the work for project hardware consultation to owner, architect and contractor.
2. Supplier will be responsible for detailing, scheduling and ordering of finish hardware.
3. Conduct pre-installation conference at jobsite. Initiate and conduct with supplier, installer and related trades. Coordinate materials and techniques and sequence complex hardware items and systems installation.
4. Key Conference shall be initiated and conducted with owner to determine system, keyway(s) and structure.

C. Installer Qualifications:

1. Installer to have not less than 3 years' experience specializing in installation of work in this section. Company must maintain qualified personnel trained and experienced in installing hardware.

1.3 REFERENCES

A. NFPA80 – Fire Doors and Windows

B. NFPA101 – Life Safety Code

C. NFPA105 – Smoke and Draft Control Door Assemblies

D. ANSI A117.1 Accessible and Usable Buildings and Facilities

1.4 SUBMITTALS

A. Hardware schedule: Submit digital copies of schedule. Organize vertically formatted schedule into Hardware Sets with index of doors and headings, indication complete designations of every item required for each door or opening. Include the following:

1. Type, style, function, size, quantity and finish of hardware items.
2. Name, part number and manufacture of each item.
3. Fastenings and other pertinent information.
4. Explanation of abbreviations, symbols and codes contained in schedule.
5. Door and frame sizes, materials and degrees of swing.

B. Product Data: Submit digital copies for each product indicated.

C. Templates: Obtain and distribute templates for doors, frames, and other works specified to be prepared for installing door hardware.

D.
Wiring/Riser diagrams: As required for electric hardware indicated. ELECTRICAL COORDINATION MEETING: After receipt of approved finish hardware schedule, the hardware supplier shall organize and lead a meeting with all related suppliers and installers of electrified hardware and access control systems. Include copies of all door elevation drawings showing location of electrified hardware, point to point wiring diagrams, a separate hardware schedule only listing openings having electrified hardware as part of this section, and manufacturers' catalog cuts of electrified hardware including electrical specifications of the product, will be provided, by the hardware supplier, for each attendee at the meeting. The purpose of this meeting will be to insure that all parties understand their scope of work and the system operation and location of all electrified hardware products. Hardware supplier shall provide a system description for each hardware group that has electrified hardware.

E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

F. Keying Schedule: Prepared by or under the supervision of supplier, after receipt of the approved finish hardware schedule, detailing Owner's final keying instructions for locks.

G. Samples: Upon request submit material samples.

H. THE SPECIFICATION WRITER MUST APPROVE ALL SUBMITTALS BEFORE ORDERS CAN BE PLACED.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and protect products to project site under provisions of Division 1 and as specified herein.

B. Tag each item or package separately, with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers: Thirty years mechanical, two years electrical
b. Exit Devices: Three years mechanical, one year electrical
c. Locksets: Ten years(ND), three years (everything else), one year electrical

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Provide all door hardware for complete work, in accordance with the drawings and as specified herein.

B. Provide items and quantities not specifically mentioned to ensure a proper and complete operational installation.

2.2 MANUFACTURERS

A. Approval of products from manufacturers indicated as "Acceptable Manufacturer" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

ITEM	SCHEDULED MANUFACTURER	ACCEPTABLE MANUFACTURER
Hinges	Ives (IVE)	Hager, Bommer
Flush Bolts & Coordinators	Ives (IVE)	Burns, Rockwood
Locksets & Deadlocks	Schlage (SCH)	None
Aluminum Door Locks - Narrow Style	Adams Rite (ADA)	None
Exit Devices & Mullions	Von Duprin (VON)	None
Electric Strikes	Von Duprin (VON)	Trine, SDC
Power Supplies	Von Duprin (VON)	Falcon
Cylinders & Keying	Schlage (SCH)	None
Door Closers	LCN (LCN)	None
Automatic Operators	LCN (LCN)	Horton
Door Trim	Ives (IVE)	Trimco, Burns
Protection Plates	Ives (IVE)	Trimco, Burns
Overhead Stops	Glynn-Johnson (GLY)	Rixson, Sargent
Thresholds & Weatherstrip	Zero (ZER)	Pemko

2.3 HANGING

A. Conventional Hinges: Hinge open width minimum, but of sufficient throw to permit maximum door swing. Steel or stainless steel pins:

1. Three hinges per leaf to 7 feet, 6-inch height. Add one for each additional 30 inches in height or any fraction thereof.
1. Provide 4 ½ x 4 ½ for 1 ¾" thick doors up to 3'5". Provide 5 x 4 ½ on doors 36" and over.
2. Exterior outswing doors to have non removable (NRP) pins.
3. Pin tips, flat button, finish to match leaves
4. Interior doors over 36" – Heavy weight
5. Interior doors up to 36" – Standard weight

2.4 LOCKSETS, LATCHSETS, DEADBOLTS

A. Heavy Duty Mortise Locks and Latches: Schlage L9000 Series

1. Provide mortise locks certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security.
2. Provide lock case that is multi-function and field reversible for handing without opening case, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
5. Provide electrified options as scheduled in the hardware sets.

6. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Lever Design: Schlage 06A

2.5 EXIT DEVICES

A. Panic and Fire Rated Exit Devices: Von Duprin 98/99 Series

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Provide compression springs in devices, latches, and outside trims or controls; tension springs also acceptable.
4. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide exit devices with manufacturer's approved strikes.
6. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
7. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
8. Provide cylinder [hex-key] dogging at non-fire-rated exit devices, unless specified less dogging.
9. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.
10. Provide UL labeled fire exit hardware for fire rated openings.
11. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
12. Provide electrified options as scheduled.
13. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

    a. Lever Style: Match lever style of locksets.

B. Panic and Fire Rated Exit Devices: Von Duprin 98/99 Series

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, AND UL listed for Panic Exit or Fire Exit Hardware.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Quiet Operation: Incorporate fluid damper or other device that eliminates noise of exit device operation.

4. Touchpad: Extend minimum of one half of door width, but not the full length of exit device rail. Provide end-cap with two-point attachment to door. Provide compression springs in devices, latches, and outside trims or controls; tension springs prohibited.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrical requirements.

2.6 ELECTRIC STRIKES

A. Manufacturers and Products: Von Duprin 6000 Series

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary-resistant.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide fail-secure type electric strikes, unless specified otherwise.
5. Coordinate voltage and provide transformers and rectifiers for each strike as required.

2.7 KEYS, KEYING, AND KEY CONTROL

A. See Keying Requirements in this section

2.8 CLOSERS

A. Surface Closers: LCN 4040XP Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 3/4 inch (19 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.9 AUTOMATIC OPERATORS

A. Electro-Mechanical Automatic Operator: LCN Senior Swing

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI A156.19.
2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors.
3. Provide drop plates, brackets, or adapters for arms as required to suit details.
4. Provide hard-wired motion sensors and/or actuator switches for operation as specified. Provide weather-resistant actuators at exterior applications.
5. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

2.10 OTHER HARDWARE

A. Door stops: Provide stops to protect walls, casework or other hardware.

1. Except as otherwise indicated, provide stops (wall, floor or overhead) at each leaf of every swinging door leaf.
2. Where wall or floor stops are not appropriate, provide overhead holders.

B. Weatherstrip and Gasket

1. Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled.
2. Provide non-corrosive fasteners as recommended by the manufacturer for application indicated.

C. Thresholds

1. Except as otherwise indicated, provide standard metal threshold unit of type, size and profile as detailed or scheduled.

D. Silencers

1. Interior hollow metal frames, 3 for single doors, 2 for pairs of doors.

E. Kickplates

1. Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

2.11 HARDWARE FINISH

A. Provide the following finishes unless noted differently in hardware groups:

Hinges	630 Stainless Steel Exterior, 652 Dull Chrome Interior
Locksets	626 Dull Chrome
Exit Devices	626 Dull Chrome
Closers	689 Aluminum
Kickplates	630 Stainless Steel
Other Hardware	626 Dull Chrome
Thresholds	Aluminum
Weatherstrip/Sweeps	Aluminum

2.12 KEYING REQUIREMENTS

A. All keyed cylinders shall be subject to a the Primus D145 key system.

B. Furnish cylinders with construction cores. Following construction supply permanent keyed cores.

C. Cylinders to be furnished with visual key control with key code. Stamped on the face of the keys and marked on the back or side of the cylinders.

D. Key Quantities
   - 6 EA Master Keys
   - 4 EA Control Keys
   - 2 EA Construction Control Keys
   - 10 EA Construction Keys
   - 3 EA Change Keys per keyed alike group

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that walls and frames are square and plumb before hardware installation.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes. Notify Architect of any code conflicts before ordering materials.

3.2 INSTALLATION

A. Do not install surface mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.

B. Locate floor stops not more than 4 inches from the wall.

C. Drill pilot holes for fasteners in wood doors and/or frames.

3.3 ADJUSTING

A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.

B. Hardware damaged by improper installation or adjustment methods to be repaired or replaced to Owner's satisfaction.

3.4 FOLLOW UP INSPECTION

A. Installer to provide letter of agreement to Owner that approximately 6 months after substantial completion, installer will visit project with representative of the manufacturers of the locking devices and door closers to accomplish the following:

1. Re-adjust locks and closers
2. Evaluate maintenance procedures and recommend changes or additions, and instruct Owner's personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems and likely future problems.

3.5 DEMONSTRATION

A. Demonstrate electrical, electronic and pneumatic hardware system including adjustment and maintenance procedures

3.6 PROTECTION/CLEANING

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

DOOR HARDWARE GROUPS

Hardware Group No. 01

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	L9070R 06A		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	GASKETING	488FSBK PSA		BK	ZER

Hardware Group No. 02

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
1	EA	ELECTRIC STRIKE	6210 FSE 12/16/24/28 VAC/VDC	✓	630	VON
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE
1			CARD READER - WORK OF DIVISION 28			
1			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 03

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
2	EA	MANUAL FLUSH BOLT	FB358		US26D	IVE
1	EA	DUST PROOF STRIKE	DP2		US26D	IVE
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
2	EA	WALL STOP	WS406/407CCV		626	IVE
2	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 04

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	L9070R 06A		626	SCH
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	GASKETING	488FSBK PSA		BK	ZER

Hardware Group No. 05

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP		630	IVE
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
1	EA	ELECTRIC STRIKE	6210 FSE 12/16/24/28 VAC/VDC		630	VON
1	EA	OH STOP	100S ...OR WS VERIFY		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	50AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER
1			CARD READER - WORK OF DIVISION 28			
1			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 06

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	NOTE	HARDWARE BY DOOR SUPPLIER			

Hardware Group No. 07

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
1	EA	ELECTRIC STRIKE	6210 FSE 12/16/24/28 VAC/VDC		630	VON
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1			CARD READER - WORK OF DIVISION 28			
1			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 08

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	SET	GASKETING	50AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A-223		A	ZER

Hardware Group No. 09

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 10

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 4" X 16"		630	IVE
1	EA	PULL PLATE	8302 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 11

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	L9070R 06A		626	SCH
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 12

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
1	EA	ELECTRIC STRIKE	6210 FSE 12/16/24/28 VAC/VDC		630	VON
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1			BALANCE OF HARDWARE BY GATE MANUFACTURER			
1			CARD READER - WORK OF DIVISION 28			
1			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 13

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
1	EA	ELECTRIC STRIKE	6210 FSE 12/16/24/28 VAC/VDC		630	VON
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		626	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	DOOR BOTTOM	360AA		AA	ZER
1			CARD READER - WORK OF DIVISION 28			
1			POWER SUPPLY - WORK OF DIVISION 28			

Hardware Group No. 14

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080R 06A		626	SCH
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	DOOR BOTTOM	360AA		AA	ZER

3.7

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. Section includes:

1. Glass for windows, doors, interior borrowed lites, storefront framing.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 064116 "Architectural Cabinets" for glazing in casework.
2. Section 085653 “Bullet Resistant Transaction Window” for bullet resistant glazing
3. Section 084113 "Aluminum-Framed Entrances and Storefronts."

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type ofthe following products; 12 inches (300 mm) square.
1. Insulating glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturers of insulating-glass units with sputter-coated, low-E coatings.

B. Product Test Reports: For insulating glass, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and

cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to 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.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Guardian Glass LLC: www.guardianglass.com/#sle.

B. Viracon Inc: www.viracon.com/#sle

C. AGC Glass North America, Inc: www.agcglss.com/#sle

D. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle

2.2 PERFORMANCE REQUIREMENTS – GENERAL

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glazing, including comprehensive engineering analysis according to ICC's 2018 Building Code by a qualified professional engineer, licensed in the state of Washington, using the following design criteria:
1. Design Wind Pressure: As indicated on drawings.
2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal Performance: Values indicated are required for conformance with the 2018 Washington State Energy Code. Alternate products must provide equal or superior performance for possible consideration.

2.3 PERFORMANCE REQUIREMENTS – EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
   4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   5. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continually of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. To utilize inner pane of multiple pane insulating glass units for continuity of vapor retarder and/or air barrier.
   2. To maintain a continuous vapor retarder and/or air barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

C. Thermal Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkley National Laboratory (LBNL) WINDOW 6.3 computer program.

2.4 GLASS MATERIAL

A. Float Glass: Provide float glass based on glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I – Transparent Flat, Class 1 – Clear, Quality – Q3.
   2. Kind HS – Heat-Strengthened, Type: Complies with ASTM C1048.
   3. Kind FT – Fully Tempered Type: Complies with ASTM C1048.
   4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous location.
   5. Tinted Type: ASTM C1036, Class 2 – Tinted, Quality – Q3, with color and performance characteristics as indicated.
   6. Thickness:
      a. Where thickness is indicated, it is a minimum. Provide glass lites in thickness as needed to comply with requirements indicated, including exterior wind load design.
   7. Strength:
      a. Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or King FT heat-treated float glass as needed to comply with “Performance Requirements articles. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.5 INSULATING GLASS UNITS

A. Manufacturers
   1. Basis of Design: Guardian Glass, LLC
   2. Viracon Inc.
   3. Or Approved Equal.

B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing special warranty.

2.6 SOLAR CONTROL INSULATING COATED GLASS UNITS (IGU-1)

A. Double-Glazed Sputter-Coated Insulating Glass Units: Vision glazing.
   1. Application: Exterior insulating glass glazing unless otherwise indicated.
   2. Space between lites filled with Argon.
   3. Total Thickness: 1 inch
   4. Thermal Transmittance (U-Value): See requirements for window assembly, Section 084113 “Aluminum-Framed Entrances and Storefronts .
   5. Solar Heat Gain Coefficient (SHGC): 0.28, nominal.
   6. Glazing Method: Dry glazing method, gasket glazing.
   7. Durability: Certified by an independent testing agency to comply with ASTM E2190, Class CBA.
   8. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO.
   9. Warm-edge Spacers: Closed cell polymer foam.
      a. Spacer Width: As required for specified insulating glass unit.
      b. Spacer Height: 0.27 inch
   10. Spacer Color: Black
   11. Edge Seal:
      a. ASTM E2188, with aluminum spacers and silicone sealant for glass-to-spacer seals.
   12. Color: Black
   13. Sealant: Approved by glass manufacturer.
   14. Purge interpane space with dry air, hermetically sealed.
   15. Basis of Design: Guardian Glass LLC
   16. Outboard Lite: Sputter-coated tinted float glass.
      a. Annealed tinted float glass, ¼ inch ASTM C1036, Type 1, Class 2, Quality Q3
         1) Coating:
            a) Low-E Coating: Sunguard SN 68 on #2 surface.
            b) Heat Treatment: Heat-strengthened, ASTM C1048, Kind HS; or Tempered (over/adjacent to doors , and transoms) Kind FT; CPSC 16 CFR 1201; ANSI Z97.1
   17. Inboard Lite: Annealed float glass, ¼ inch thick, ASTM C1036, Type 1, Class 1, Quality Q3.
      a. Coating: SunGuard IS 20 on #4 surface.
      b. Glass: Clear.
      c. Heat Treatment: Fully Tempered, ASTM C1048, Kind FT; CPSC 16 CFR 1201; ANSI Z97.1.

2.7 GLAZING UNITS

A. Monolithic Interior Safety Glazing: Non-fire rated.
   1. Applications:
      a. Glazed lites in doors, except fire doors.
      b. Glazed sidelights and transoms to doors, except in fire-rated walls and partitions.
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. Other locations indicated on drawings.
   2. Glass Type: Fully tempered safety glass as specified.
   3. Tint: Clear.
   4. Thickness: ¼ inch nominal.

2.8 GLAZING SEALANT

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with on 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 manufacturer's written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. VOC Content: Sealants used inside the waterproofing system shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   4. As approved by glass manufacturer.

B. Type GC-2 – Butyl Sealant: Single component: ASTM C920 Grade NS, Class 12-1/2 Uses M and A Shore A hardness of 10 to 20; black color.

C. Type GC-4 – Polyurethane Sealant: Single component, chemical curing, nonstaining, nonbleeding; ASTM C920 Type s, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected by architect.

D. Type GC-5 – Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Classs 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected by architect.

E. Manufacturers:
   1. Dow Corning Corporation.
   2. Master Builders Solutions.
   3. Pecora Corporation.
   4. Tremco Commercial Sealants & Waterproofing.

2.9 ACCESSORIES

A. Cleaners, Primers, and Sealants: Types recommended by gasket manufacturer.

B. Setting Blocks: EPDM, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum of 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

C. Spacer Shims: Neoprene, 80-90 Shore A hardness: ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, or continuous as needed to maintain glass lites in place for installation indicated, self-adhesive on one face.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

F. Glazing Clips: Manufacturer's standard type.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. 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.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

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.

G. 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.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

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 GASKET GLAZING (DRY)

A. Cut compression gaskets to 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. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. 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.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces 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 091300 – ACOUSTICAL SUSPENSION SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exposed suspended tee grid for lay-in panels.

1.2 RELATED SECTIONS

Section 095100 - Acoustical Ceiling Panels

1.3 REFERENCED STANDARDS

ASTM C 636	Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
ASTM C 365	Metal Suspension Systems for Acoustical Tile and Lay in Panel Ceilings
UBCS 25-2	Uniform Building Code Standard

1.4 SUBMITTALS

A. Design data: Submit calculations defining compliance with seismic bracing requirements of UBC. Design is required to bear stamp of Structural Engineer licensed in Washington State.

1. Completed installations are required to support finished acoustical ceiling assemblies including mechanical and electrical lay-in units with maximum deflection of 1/360th of the span in accordance with referenced ASTM C 635 Heavy Duty Classification.

B. Shop Drawings (reflected ceiling plans). Indicate layout and:

1. Insert and hanger spacing and fastening details.

2. Splicing method for main runners and cross tees.

3. Changes in level.

4. Acoustical unit support at electrical fixtures, mechanical diffusers.

5. Lateral sway bracing as required by UBC standard 25-2.

C. Manufacturer's definitive brochures with recommendations for suspension system installation.

D. Full-sized sample of grid system units.

1.5 QUALITY ASSURANCE

A. Installer qualifications: A Specialist as defined in Section 01075.

B. Regulatory requirements: Comply with Uniform Building Code Standard 25-2 for installation of suspension system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original, unopened, protective packaging. Attach legible manufacturer's labels indicating brand name, size, and thickness.

B. Verify undamaged condition at time of site acceptance.

C. Store products in original protective packaging in safe, protected location.

D. Do not begin installation until sufficient materials are received to complete space.

E. Prevent soiling and physical damage.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Armstrong World Industries, Inc.

B. USG/Donn.

C. Substitutions under provisions of Section 016300.

2.2 PRODUCTS

A. Armstrong Prelude grid system

B. Main runners and cross tees: 15/16-inch wide x 1-1/2 inches high. Finish on exposed surfaces is to be non-sheen.

C. Provide main runners and cross tees with slide locking tabs 24 inches oc to allow for 90-degree rotation of cross tees.

D. Suspension wires for light fixtures: Heavy-duty according to UBC 25-2. Independent of grid suspension.

E. Wall molding and edge trims: Manufacturer's standard, Fry, or specially fabricate to detail. Match and support the framing detachably.

F. Color: White.

2.3 FABRICATION

A. Manufacturer's standard fabrication: Form grid members from commercial quality cold-rolled steel. Exposed surfaces painted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected.

1. Examine for unevenness and irregularities.

2. Determine that mechanical and electrical work in space above ceiling is complete.

3. Ensure that walls, windows, and other required items are in place.

3.2 PREPARATION

A. Field measurements: Measure on job prior to installation.

B. Coordinate entire scheduled acoustical ceiling areas with mechanical and electrical penetrations, and inserts.

3.3 INSTALLATION

A. Install the work in accordance with References and manufacturer's directions.

B. Rough suspension: Hanger wires in accordance with UBC Standard 25-2:

1. Space in accordance with referenced ASTM C 636.

2. Install hangers within 6 inches of each corner of light fixtures, if dead load of fixture exceeds deflection capability of ceiling suspension system.

3. Install hangers 6 inches from vertical surfaces.

4. Hangers splayed more than 5 inches in vertical drop require approval of Construction Manager.

5. Locate anchors so that hangers do not interfere with mechanical or electrical work.

6. Do not support from ductwork or piping.

7. Sway bracing: Install in accordance with referenced UBC.

C. Carrying channels: At locations where mechanical equipment above ceiling exceeds the specified spacing, size and provide carrying channels and hangers to span the required dimension to clear the equipment.

D. Wall moldings and edge trims:

1. Install wall moldings at interface with vertical surfaces.

2. Include outside corner caps.

3. Attach to vertical surfaces with mechanical fasteners.

4. Install required trims as indicated.

E. Provide hangers, channels, connectors, clips, and similar supports required for installation of ceiling-related accessories.

F. Allowable tolerances:

1. Level main runners and cross tees to within 1/8 inch in 12 feet.

2. Maximum deflection for suspension system, including components, hangers, fastening devices, lighting fixtures, ceiling grills, and acoustical panels is not to exceed 1/360th of span.

3.4 CLEANING

A. Clean soiled or discolored surfaces after installation.

B. Remove and replace damaged or improperly installed units.

C. Remove debris resulting from work of this section.

3.5 EXTRA STOCK, SPARE PARTS

A. Maintenance material:

1. Furnish extra material of each type, equal to 1% of grid lineal footage.

2. Obtain written receipt when delivered to Construction Manager.

END OF SECTION091300

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for metal stud framing.
2. Section 093013 "Ceramic Tiling" for tile backer board installed as substrate for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: Provide product data on gypsum board, accessories, and joint finishing system.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

1. Manufacturers:
   a. CertainTeed Corporation
   b. Georgia-Pacific Gypsum
   c. National Gypsum Company
   d. USG Corporation

B. Gypsum Board, Type X: ASTM C1396/C1396M.
1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.
1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

D. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.
1. Core: 5/8 inch (15.9 mm), Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds **Level 1** requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds [**Level 1**] [**Level 2**] [**Level** requirements.
5. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless otherwise noted.
2. Shapes:

   a. Cornerbead.
   b. LC-Bead: J-shaped; exposed long flange receives joint compound.
   c. L-Bead: L-shaped; exposed long flange receives joint compound.
   d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   e. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.
2. Finish: Clear anodized.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Materials: As recommended by gypsum board manufacturer for project conditions.

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

D. Sound-Attenuation Blankets: ASTM C665, 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PANELS, GENERAL

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Aluminum Trim: Install in locations indicated on Drawings.

3.4 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3. Level 5: North Wall of Lobby.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.5 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Glazed wall tile .
2. Porcelain tile.
3. Tile backing panels.
4. Waterproof anti-fracture membrane.
5. Metal edge strips.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

C. Samples for Verification:

1. Full-size units of each type of trim and accessory for each color and finish required.
2. Metal edge strips in 6-inch (150-mm) lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a member of the National Tile Contractors Association or a of the Tile Contractors' Association of America.

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 requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store liquid materials in unopened containers and protected from freezing.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

B. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.2 TILE PRODUCTS

A. Ceramic Tile Type CT-1: Porcelain floor tile.
1. Size: 12 inched by 24 inches nominal.
2. Thickness: 5/16 inch
3. Color: Charcoal Grey
4. Finish: Matte
5. Pattern: Stacked
6. Trim: Metal trim at material transitions.
7. Products:
a. Daltile Corporation; Ironcraft, Charcoal grey
b. Daltile Corporation: Revo Tile, Power grey
~~A.~~c. Or approved equal

B. Ceramic Tile Type CT-2: Glazed wall tile.

1. Size: 4 inches by 18 inches nominal (4 inches by 12 inches for Natural Hues)
2. Thickness: 3/8 inches (9.30 mm)
3. Color: Arctic White
4. Surface Finish: Glossy
5. Pattern: Stacked Bond, see drawings.
6. Trim: Non-ceramic Trim.
7. Products:
a. Daltile Corporation; Color Wheel Linear.
b. Daltile Corporation; Natural Hues
c. Or Approved Equal.

C. Ceramic Tile Type CT-3: Glazed accent wall tile

1. Size: 3 inches by 12 inches nominal
2. Thickness: 5/16 inches (7.90 mm)
3. Color: Galaxy
4. Surface Finish: Undulating, glossy
5. Pattern: Herring Bone, see drawings
6. Trim: Non-ceramic Trim.
7. Products:
a. Daltile Corporation; Stagecraft.
b. Daltile Corporation; Color Match
c. Or Approved Equal

2.3 TILE BACKING PANELS

A. Glass-Mat Backerboard.

1. Manufacturers:
a. Basis of Design: Subject to compliance with project requirements, the design is based on the following: USG Corporation, LLC, USG Durock Brand Glassmat Tile Backerboard.
b. Georgia-Pacific Gypsum LLC, DensShield Tile Backer
c. Or Approve Equal.

2. Classification: ASTM C1178, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel. USG Durock™ Glass-Mat Tile Backerboard exceeds ASTM C1178, which is the standard specification for coated glass-mat water-resistant gypsum backing panels.
   a. Thickness: 1/2 inch (12.7 mm)
   b. Board Length: 8 feet (2438 mm)
   c. Board Length: 8 feet (2438 mm)
   d. Mold Resistance: ASTM D 3273, score of 10.
3. Fastener Requirements: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and application.
   a. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: DUROCK Tile Backer Screws appropriate for thickness of materials.
4. Panel Installation Requirements:
   a. Install backerboard with ends and edges closely abutted but not forced together. Stagger end joints in successive courses.
   b. For wall application, fasten USG Durock™ Glass-Mat Tile Backerboard to framing with specified fasteners. Drive fasteners into field of panels first, working toward ends and edges. Hold panels in firm contact with framing while driving fasteners. Space fasteners maximum 8" o.c. for walls, 6" o.c. for ceilings, with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges. Drive nails and screws so bottoms of heads are flush with panel surface. Do not overdrive fasteners. Approved fasteners include: USG Durock™ Tile Backer Screws for steel framing (or equivalent), 1-1/4" and 1-5/8" for 14- to 20-gauge steel framing; USG Durock™ Tile Backer Screws for wood framing (or equivalent), 1-1/4", 1-5/8" and 2-1/4" for wood framing; and nails (1-1/2" hot-dipped galvanized roofing nails). Prefill joints and then immediately embed USG Durock™ Tile Backer Tape and level joints. Maintain 1/4" gap between USG Durock™ Glass-Mat Tile Backerboard and tub surround.
   c. Panels should be cut to size with a knife and straight edge. A power saw should be used only if it is equipped with a dust-collection device. Installer should wear NIOSH/MSHA-approved dust mask.

2.4 WATERPROOF ANTIFRACTURE MEMBRANE

A. Waterproof and Anti-fracture Fabric Membrane full floor coverage, return up walls 6 inches.

1. Waterproof anti-fracture membrane shall be 40 mil (1 mm) minimum thickness, self-bonding, ASTM D412/D751 compliant for elongation, ASTM E42/C627 compliant for impact resistance/system performance, ASTM E96 compliant for moisture transmission. Fabric reinforced laminate sheet with self-adhesive back and fully weldable or sealable seams. All joints and seams to be covered with 2” overlap strip to be heat welded/thermoset welded.
2. Accessories:
   a. Primer
   b. Seam and Corner Tape is to be applied underneath where membrane is butt-jointed and corners.
   c. Preformed inside and outside corners.
   d. Tile bond coating meeting ANSI A 118.4.
   e. Hardener as recommended by manufacturer: Water-based chemical floor hardener.

f. Sealant: Manufacturer approved urethane sealant over membrane butt-joints and perimeters or other cut areas.

3. Manufacturers:
   a. NAC, Strataflex.
   b. Protecto Wrap AFM-WM
   c. Compotite Composeal Gold
   d. WR Meadows MEL-ROL Procon Membrane
   e. Or Approved Equal.

2.5 SETTING MATERIALS

A. Dry-Set Portland Cement Mortar (Thinset): ANSI A118.1.

1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

B. Latex-Portland Cement Dry-Set Mortar (Thinset): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

C. Organic Adhesive: ANSI A136.1, Type I.

2.6 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Mapei or approved equal. Colors to be selected from manufacturer’s standard colors, up to 4 grout colors will be used.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Trim: Provide all necessary shapes, which shall be of the same manufacturer, material, color and finish.

1. Manufacturers:
   a. Basis of Design: Schluter
   b. Manhattan American

c. Approved Equal

2. Transition and Edge Strips
   a. Quadec: all outside corners
   b. Jolly: top of wainscot, floor transitions to other materials, exposed edges of tile

C. 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.

D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    c. Tile floors consisting of rib-backed tiles.

B. 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.

C. 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.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Glazed Wall Tile: 1/16 inch (1.6 mm).
2. Porcelain Tile: 1/8 inch (3.2 mm

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install as indicated on drawings and above.

K. Floor Sealer: Apply floor sealer to grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093013

SECTION 095100 – ACOUSTICAL CEILING PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lay-in acoustic ceiling panels in suspended exposed tee grid.

1.2 RELATED SECTIONS

Section 091300 - Acoustical Suspension Systems

1.3 REFERENCED STANDARDS

UBC Uniform Building Code Standard 47.18

UL Underwriters Laboratories Inc. - Fire Resistance Directory and Fire Hazard Classification

1.4 SYSTEM DESCRIPTION

A. Unless otherwise detailed, system is square edge panel set into a suspended grid system as specified in Section 091300.

1.5 SUBMITTALS

A. Certification of compliance with Underwriters Laboratories Inc., fire resistance directory and fire hazard classification.

B. Shop Drawings: Submit reflected ceiling plan Drawings coordinated with the acoustical suspension system manufacturer (Section 091300).

C. Manufacturer's technical data for each product.

D. Submit samples of each pattern illustrating range of appearance.

1.6 QUALITY ASSURANCE

A. Installer qualifications: A Specialist as defined in Section 010750. Installer is required to—

1. Be approved by systems manufacturers.

2. Submit listings of a minimum of three installations comparable to proposed Project.

3. Submit written description of installer experience. Submit manufacturer's approval of installer.

B. Uniform Building Code Seismic - Standard 47.18.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original unopened packaging. Manufacturer's labels indicating brand name, pattern, size, and thickness are required to be attached and legible.

B. Verify undamaged condition at time of site acceptance.

C. Store materials in original protective packaging to prevent soiling and physical damage.

D. Store cartons and bundles in a covered area at temperature and humidity required by manufacturer.

1.8 BUILDING INTERIOR CONDITIONS

A. Environmental requirements: Do not begin installation until wet work, such as concrete, is completely dry and facility is water and weather tight. These materials are designed for installation under standard occupancy conditions from 60°F to 85°F, at not more than 80% relative humidity in an enclosed building.

1.9 MAINTENANCE

A. Provide extra materials for maintenance and repair.

1. 2% computer areas.

2. 5% other areas.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Armstrong, USG Interiors, Inc. - Armstrong selections are indicated for quality and design.

B. Substitutions under the provisions of Section 016300.

2.2 MATERIALS

A. Armstrong Optima Series - Nominally 24 x 48 x 15/16 inches. Panels to have a fissured surface and tegular edges. NIC - Speech privacy noise isolation class 17, NRC range .65-.75, STC range 35-39, flame spread 25 or under. Color – white.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected.

1. Provide interface with acoustical suspension system before execution. Examine surfaces for evenness and regularity.

3.2 INSTALLATION

A. Install the work in accordance with manufacturer's directions.

B. Coordinate acoustical panels and suspension system installation with electrical and mechanical trades to ensure continuity.

C. Note layout of reflected ceiling plan. Obtain Construction Manager's approval of layout in field before installation.

3.3 CLEANING AND REPLACEMENT

A. Clean, remove, or replace soiled, discolored, damaged, or improperly installed work, as required.

1. Coordinate with overall construction cleaning.

END OF SECTION095100

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

C. Delegated Design Submittals: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, 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.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Ceiling System: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 ACOUSTICAL PANELS

A. Manufacturers:
   1. Armstrong: Optima Acoustical
   2. USG: Mars High-NRC
   3. Certainteed: Symphony
   4. Or Approved Equal.

B. Acoustical Panel:
   1. Size: 24 inches by 48 inches.
   2. Thickness: 1 inch
   3. Composition: Fiberglass
   4. Edges: Square
   5. Texture: Fine
   6. NRC: 0.90
   7. CAC: 26

C. Spare and extra parts shall be identified for all products, but not provided. Include spare parts information in Operations and Maintenance Manuals.

2.3 METAL SUSPENSION SYSTEM

A. General: Provide the system manufactured in accordance with requirements of ASTM C635 and as follows: direct-hung type; intermediate heavy-duty classification; seismic bracing as required to conform to IBC requirements. Sections fabricated of Type 6063 T5 extruded aluminum with cross “T’s” offset to furnish flush surface with underside of main runner “T’s”; finish in white paint finish. Include all main “T’s,” cross “T’s,” wall moldings and other accessories required for complete installation.

B. Accessories: Provide the following accessories for installation where specified or noted:
   1. Hold-Down Clips: Acoustical materials of manufacturer’s standard type for lay-in panels; number, type and spacing as required for conformance with fire tests.

2. Metal Edge Trim: Corrosion-resistant sheet steel; angle or “J” shape; size as suitable for acoustical material; bonderized and painted to match acoustical material.

C. Hangers: Galvanized, soft-annealed steel wire; gage certified by load test data for five times design load, but in no case less than 12 gage.

D. Struts, Sway Bracing, Clips, and Edge Trim: Provide all required for conformance with code seismic requirements

E. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M and designated by type, structural classification, and finish indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Install acoustical panel ceilings in accordance with ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
1. Inspection: Inspect all spaces to review acoustical ceiling installations to verify their readiness to receive Work. Commencement of installation constitutes acceptance of the Work of other trades. Verify that perimeter wall Work where ceiling abuts is complete and dry, and that all Work above ceiling is complete. It is the Contractor’s responsibility to coordinate the Work of all trades to avoid interference in accordance with requirements of ASTM C636.
2. Suspension Systems: Install systems in accordance with the requirements of ASTM E580 and as specified hereinafter. Install systems complete where scheduled, including hanger

wires and their anchors or attachment devices. Install perimeter moldings and trim straight and level at heights indicated. Install main runners and cross runners in accordance with ASTM E580. Install main runners on 24-inch centers and connect cross runners at 48-inch centers. Space stabilizer bars at not more than 96-inch centers perpendicular to main runners.

3. Acoustical Panels: Install with tight joints. Cut and fit material as required for installation; where required for fit, provide specially sized or cut pieces and install at perimeters only. Unless otherwise approved, install to true and level planes with all abutting edges flush. Make border units not less then one-half size when measured perpendicular to wall; edge joints tight and in straight lines.
4. Miscellaneous and Cleanup:
    a. Damage: Unless otherwise approved, replace all damaged and defaced materials.
    b. Cleanup: Upon completion and after balancing of mechanical systems, clean all soiled materials; reinstall ceilings and level to required lines.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 095426 - WOOD GRILLE CEILING AND WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-wood grille ceilings.
2. Solid-wood wall panels.

1.2 REFERENCE STANDARDS

A. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

B. CISCA (WC) – Wood Ceiling Technical Guidelines 2009.

1.3 COORDINATION

A. Coordinate layout and installation of wood ceilings and suspension systems with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Solid-wood grille ceilings.
2. Solid-wood wall panels.

B. Shop Drawings: For suspended wood ceilings.

1. Include reflected ceiling plans, elevations, sections, and details, drawn to scale, showing the following:

a. Wood ceiling and wall patterns and joints.
b. Ceiling suspension members.
c. Method of attaching hangers to building structure and locations of cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
d. Ceiling-mounted items including, but not limited to, light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
e. Ceiling perimeter and penetrations through ceiling; trim and moldings.

C. Samples: For each exposed product and for each type, color, and finish specified, 12 inches (305 mm) long by 12 inches (305 mm) wide or full width in size.

D. Delegated Design Submittals: For design of seismic restraints and attachment devices.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each suspended wood ceiling, for tests performed by a qualified testing agency.

B. Evaluation Reports: For suspended-wood-ceiling framing systems.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacture Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

B. Installer Qualifications: Company specializing in performing the work of this section.
   1. Minimum 5 years documented experience.
   2. Approved by wood ceiling manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver ceiling components and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

   1. Store materials flat and level, raised from the floor.

B. Handle ceiling components and accessories in a manner that prevents damage.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install interior ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

   1. Store and acclimatize wood products in the spaces where they will be installed for a minimum of 72 hours immediately before ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements" to design seismic restraints and attachment devices.

B. Structural Performance: Exterior suspended wood ceilings to withstand exterior exposure, the effects of gravity loads, and the following loads and stresses without showing permanent deformation of ceiling system components or permanent damage to fasteners and anchors:

2.2 MANUFACTURERS

A. Wood Ceiling and Wall Panels:
1. Basis of Design: 9Wood; 1100 Cross Piece Grille: www.9wood.com/#sle
2. LINEA Ceiling & Wall Systems, LINEA Grille
3. Or Approved Equal.

B. Wood Gilles: Pre-assembled module of solid wood grilles with battens.
1. Species: Hemlock
   a. Factory Finish: Clear.
2. Module Width: 12 inch wide, nominal.
3. Member Size: Square edge, 1-3/8 inches wide by 2-1/4 inches deep
4. Grille Spacing: 4 Grille Members per Linear Foot
5. Acoustical Felt Backer (at Shared Conf and Lobby): Duct Liner, ½ inch thick set between cross piece and back scrim,
   a. Color: Black
6. Cross Piece Backer: ½ inch by 1-1/4 inch nominal plywood strips painted black.
7. Reveal Scrim: Black reveal scrim.
8. Attachment to Ceiling and Wall Surfaces: Attach scrim grille support frame to ceiling and wall, and direct screw to block, studs, or suspension system.

C. Accessories: Manufacturer’s standard accessories for installation method indicated.

2.3 FABRICATION

A. Shop fabricate wood ceiling and wall components to the greatest extent possible.

B. Fabricate components to all access to mechanical and electrical components as required.

2.4 SUSPENSION-SYSTEM HANGERS, BRACES, AND TIES

A. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.

B. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C635/C635M, Table 1, Direct Hung is less than yield stress of wire, but provide not less than 0.135-inch- (3.4-mm-) diameter wire.

C. Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed from 0.04-inch- (1.0-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

E. Seismic Stabilizer Bars: Grid-suspension-system manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Suspension-system manufacturer's standard compression struts designed to accommodate seismic forces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which suspended wood 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 suspended wood ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of suspended wood ceilings.

1. Balance border widths at opposite edges of each ceiling.
2. Avoid using less-than-half-width units.

3.3 INSTALLATION OF SUSPENDED WOOD CEILINGS

A. Comply with ASTM C636/C636M and seismic requirement indicated, in accordance with manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members at canopies, 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. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard

suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns in 3 inches (76 mm). Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
5. 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.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches (1219 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (203 mm) from ends of each member.
9. 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 in 1-1/2 inches (38 mm). Suspend bracing from building's structural members as required for hangers and 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. Linear-Carrier Suspension Systems: Install carriers at no more than [24 inches (610 mm)] o.c. aligned and securely interlocked with one another.

1. Install stabilizer channels, tees, and bars at regular intervals to stabilize carriers and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated.
2. Remove and replace dented, bent, or kinked members.

E. Install wood components and accessories in accordance with manufacturer's written instructions and to accommodate natural expansion and contraction of wood products resulting from fluctuations in humidity.

F. Cut wood components for accurate fit at borders and at interruptions and penetrations by other work through ceilings.

1. Stiffen edges of cut wood components as required to eliminate variations in flatness.

G. Treat field-cut edges of wood components in accordance with manufacturer's written recommendations; finish exposed field cuts to match factory finish.

H. Install wood components in coordination with suspension system and moldings and trim.

3.4 CLEANING

A. Clean exposed surfaces of ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented units.

END OF SECTION 095426

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Thermoplastic-rubber base.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.

C. Samples for Initial Selection: For each type of product indicated.

D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 deg F (18 deg C) or more than 85 deg F (29 deg C).

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C), in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm

B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 THERMOSET-RUBBER BASE: RB-1

A. Product Standard: ASTM F1861 Standard Specification for Resilient Thermoplastic Rubber Wall Base, Type TP, Group I.

1. Manufacturers:

a. Basis of Design: Duracove, Johnsonite, a Tarkett Company
b. 700 Series, Roppe Corporation.
c. Or Approved Equal.

2. Style and Location:

a. Style A, Straight: Provide in areas with carpet.
b. Style B, Cove: Provide in areas with resilient floor covering.

B. Thickness: 0.125 inch (3.2 mm).

C. Height: 4 inches (102 mm).

D. Lengths: Cut lengths 120 inches (36.58 m) long or coils in manufacturer's standard length.

E. Outside Corners: Job formed.

F. Inside Corners: Job formed.

G. Colors: Burnt Umber #63

2.3 THERMOPLASTIC-RUBBER BASE: RB-2

A. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic), Group 1.

1. Manufacturers:

a. Basis of Design: Mandalay, Johnsonite, a Tarkett Company
b. Vertical PV6065, Roppe Corporation.
c. Or Approved Equal.

B. Thickness: 0.375 inch (9.525 mm).

C. Height: 6 inches (152 mm).

D. Lengths: 8 feet (2.44 m)

E. Colors: To be selected from manufacturer's standard Solid Colors.

2.4 VINYL MOLDING ACCESSORY

A. Description: Vinyl nosing for carpet, nosing for resilient floor covering reducer strip for resilient floor covering, and joiner for resilient floor and carpet

B. Profile and Dimensions: Manufacturer's standard profiles for conditions listed above.

C. Locations: Provide vinyl molding accessories in all transition locations.

D. Colors and Patterns: Burnt Umber

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096516 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient sheet safety flooring.
2. Resilient tile flooring.
3. Preformed athletic flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient sheet flooring.

1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples: For each exposed product and for each color, texture, and pattern specified, in manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive resilient sheet flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 RESILIENMT SHEET SAFETY FLOORING

A. Slip Resistant Sheet Safety Flooring: Homogeneous with backing, color and pattern throughout full vinyl thickness.

1. Manufacturers:
   a. Basis of Design: Altro; Reliance 25.
   b. Or Approved Equal.
2. Minimum Requirements: Comply with ASTM F1303, Type 1, Grade 1, Class A safety flooring.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. VOC Content Limits: As specified in Section 018113
5. Thickness: 2.5 mm nominal.
6. Sheet Width: 79 inch (2 mm) minimum.
7. Static Load Resistance: 2000 psi minimum, when tested as specified in ASTM F970.
8. Static Coefficient of Friction: Minimum 0.8 as specified by ASTM D2047/UL 410.
9. Dynamic Coefficient of Friction: Minimum 0.5 wet as specified byt ANSI/NFSI B101.3
10. Seams: Heat welded.

11. Color: Selected from manufacturer's full range of colors.
12. Other material requirements:
    a. Formaldehyde free.
    b. Ortho-phthalate free.
    c. FloorScore Certified
    d. Recycled content: 10% post-consumer recycled content, minimum.

2.3 RESILIENT TILE FLOORING

A. Vinyl Tile: Printed film type, with transparent or translucent wear layer and acoustic backing

1. Manufacturers:
    a. Basis of Design: ShawContract, Inspire 5.0 Mm, Mindful Play
    b. Or Approved Equal.
2. Minimum Requirements: Comply with ASTM F1700, Class B, Type B
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Static Coefficient of Friction: Minimum 0.6 as specified by ASTM D2047/UL 410.
5. Tile Nominal Dimensions: 24 inches (61 cm) by 24 inches (61 cm).
6. Wear Layer Thickness: 20 mil (0.02 in)
7. Overall Thickness: 0.197 inches (5 mm)
8. Color
9. Installation: Direct Glue.

2.4 PREFORMED ATHLETIC FLOORING

A. Rubber Interlocking Tile Athletic Flooring

1. Manufacturers:
    a. Roppe Corporation, Recoil
    b. Ecore International, Basic Fit
    c. Or Approved Equal
2. Thickness: 3/8 inch (8 mm)
3. Color: Black with 10% color chips, selected from manufacturer's full range of standard colors.
4. Static Coefficient of Friction: 0.50 as specified by ASTM D2047

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch (25-mm) radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Square metal provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere resilient flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

I. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches (152 mm) up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096770 – RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resinous flooring, including 100% solids, low odor epoxy (EP) to be applied to designated floor surfaces.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: Provide resinous flooring which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.3 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit product data, including manufacturer's SPEC-DATA[a] product and MSDS sheets for specified products, and manufacturer's installation instructions.

C. Samples: Submit selection and verification samples for finishes, colors and textures.

D. Quality Assurance Submittals: Submit the following:

1. Manufacturer's Field Reports: Manufacturer's field reports specified herein.

E. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

2. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

a. Installer shall be an established company regularly engaged in the installation of polymer flooring systems for at least five years.

b. Contractor shall demonstrate the ability to undertake and complete the required work and furnish documentation regarding the successful completion of projects of similar size and complexity. Pre-Approved applicator is Leewens Corporation, Contact: Patrick Leewens at 206-930-3932 or 425-827-7667, Ext 105.

c. Applicator shall have attended manufacturer's training program. Certificate: When requested, submit certificate indicating qualification.

d. For approved applicators please contact manufacturer's representative listed below.

2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving surface preparation and application methods. Manufacturer's distributor/representative Brett Bechtel @ PCCI/ Seattle (206) 762-6119.

B. Regulatory Requirements: Contractor is required to follow all local, state and federal regulatory agency requirements and all specific requirements of Boeing Shared Services Group.

C. Mock-Ups: Install at project site a job or manufacturer's furnished mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, texture, pattern and workmanship standard. Comply with Division 1 Quality Control (Mock-Up Requirements) Section.

1. Mock-Up Size: Min. 12"X12".

2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.

3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

D. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

E. Preinstallation Testing: Conduct preinstallation testing as follows: If moisture is present or if moisture is a concern use a calcium chloride test kit or kits. The minimum test is ASTM Plastic Sheet Method 24"X24" taped down for 36-48 hours.

1.5 DELIVERY, STORAGE & HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.6 PROJECT CONDITIONS

A. Environmental Requirements/Conditions: Substrate and ambient air temperature shall be in accordance with manufacturer's requirements.

B. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during and after installation as recommended by manufacturer.

1.7 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

1. Resinous Flooring Warranty: Furnish a written warranty covering materials and labor against loss of adhesion and other defects resulting from normal wear and use. The technical data and other printed information furnished is true and accurate to the best of the manufacturer's knowledge. The products are warranted pursuant to acceptance of "limited warranty," a copy of which can be obtained from Neogard Inc. which is the exclusive warranty with respect to the sale of this product. The modification of any component or uses not outlined in this bulletin nullifies the warranty unless advance written confirmation is obtained from the Neogard Inc. No other warranties expressed or implied shall apply. Neogard Inc. assumes no responsibility for coverage, performance or injuries resulting from use. Liability, if any, shall be to supply replacement materials as set forth in the "limited warranty."

2. Warranty Period: One year commencing on Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING

A. Manufacturer: Neogard Inc.

1. Contact: 2728 Empire Central, Dallas, TX 75235-7624 214-353-1600 website:

   www.neogard.com. Local Representative is Protective Coating Consultants, Inc. (PCCI). Contact is Brett Bechtel, 206-762-6119 (office), 206-510-8664 (cell), email brett@pcciseattle.com.

2. 02 100% Solids EPOXY COATING

A. Neogard 70714/ 70715 Chemical Resistant Primer: 2 component 100% solids epoxy resin with a cycoaliphatic amine hardener.

B. Neogard 70714/ 70715 100% solids epoxy (EP) coating.

2.3 PRODUCT SUBSTITUTIONS

A. Substitutions: **No substitutions permitted.**

2.4 MIXES

A. Mixing: Mix proprietary materials in accordance with manufacturer's instructions, including product data and product technical bulletins.

2.5 SOURCE QUALITY

A. Source Quality: Obtain resinous materials from a single manufacturer.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

1. Before applying materials, inspect surfaces to receive new materials and report any unsatisfactory conditions. Absence of any such report shall constitute installer's acceptance of surfaces as satisfactory for installing materials.

3.3 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.

B. All surface preparation equipment shall be equipped with dust shrouds and dust collection equipment specifically designed for the purpose with backpulsing filtration.

C. All surface preparation shall be accomplished inside a tent structure large enough for the purpose, with a solid frame and Fireproof visqueen coverings. The tent shall be attached to a large ventilation system which will produce negative air pressure inside the tent and exhaust and filter air to the outside of the building.

D. Surface Preparation:

1. Chipping and Filling: Holes, cuts, joints and enlarged cracks shall be filled and leveled with an epoxy fill material as recommended by coating manufacturer before resurfacing. All surround surface elevations shall be made the same.

2. Utility trench plates, all fillers, epoxy or urethane joint fillers must be removed to provide a clean open gap between trench plates and concrete floor. Determined on a case by cases basis.

3. Coating Surface Preparation for Existing surfaces:

a. Mechanical Cleaning: Concrete floor surfaces receiving epoxy coatings shall be thoroughly cleaned prior to any mechanical preparation using a bio-degradable cleaner but not limited to such cleaner or cleaners. Once this has been completed all surfaces to be coated shall be prepared by shot blasting or some other mechanical abrading which meets ICRI Surface Preparation Standard to CSP-4 medium preparation requirements. All abandoned steel bolts or anchors shall be cut and ground down All patched and repaired areas must be ground down to achieve an even floor elevation on both sides of the repaired areas.

b. All existing coated surface shall be removed to bare concrete.

c. All repairs must be approved as acceptable prior to applying any epoxy primer.

d. Acid Etch: **Not allowed for project.**

3.4 INSTALLATION

A. Resinous Flooring Installation:

1. Coating Application:

a. Priming: Apply primer to prepared concrete substrate at a rate sufficient to result in a complete wetting-out and sealing of concrete with no dry or absorbed areas. Use Neogard 70714-Clear/70715 Chemical Resistant/Moisture resistant Epoxy Primer at 6-8 mils dft minimum.

b. Filling: Fill chuckholes, elevation transitions and low spots and trowel rough areas (such as those where coatings were removed) smooth using Neogard 70714/70715-09 as a base epoxy resin with additional fillers. Allow to cure until fills are firm enough to support a person's weight. All patched and repaired areas must be ground down to a smooth even surface to achieve an even floor elevation on both sides of the repaired areas.

c. Finish: Finish coat shall consist of an epoxy complying with the specified standards; epoxy shall be Neogard 70714-Light Gray/70715-09 Epoxy at a rate of 6-8 mils dft minimum.

d. For rougher concrete, apply thicker coats than 6-8 mils dft to result in smooth cleanable surface. Cleanable for these floors is defined as using a dust mop, wet mop or fine haired broom.

e. Expansion and Control Joints: If required use Neogard 70718/ 70719 flexible epoxy joint filler pigmented to match the finish coating. To be determined if necessary on a project by project basis.

f. Contractor is required to provide a gallon of touch up material matching the finish color.

B. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

3.5 FIELD QUALITY REQUIREMENTS

A. Inspection: Owners representative, applicator and manufacturers representative shall be available for field inspections of the substrate prior to the application of any materials. Representatives should be available to approval of coating prior to finish coat being applied.

B. Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: Field Service Representative shall provide inspections and written report of initial site review, surface preparation, repairs, primed, intermediate, broadcast and finish coats attesting that each surface was ready for subsequent coating and acceptance of finish coating. Each written field report shall contain location, approximate square footage of work to be coated, temperature, humidity and application time.

3.6 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.7 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 096700

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Resinous Flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 FIELD CONDITIONS

A. Read and follow SDS and container labels for detailed health and safety information.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

C. Moisture vapor emission of concrete substrate not to exceed 20 lbs/1,000 sq ft/24 hours, when tested by the quantitative calcium chloride test method (ASTM F1869). Relative Humidity is not to exceed 99% when tested by In-situ Probe Test (ATSM F2170).

D. Coordinate flooring work with other trades. Applicator shall have sole right of access to the specified area for the time needed to complete the application and allow the flooring system to cure adequately.

1.9 WARRANTY

A. Provide manufacturer’s standard warranty for materials and labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

2.2 MANUFACTURERS

A. Basis of Design: Neogard, part of Hempel, 2728 Empire Central, Dallas TX 214 353-1600, www.neogard.com

B. Or Approved Equal.

2.3 MATERIALS

A. Neocrete SL Broadcast Floor System (Hempel product numbers in parentheses):
   1. Crack and Joint Filler: 70718/70719 (25000) flexible epoxy.
   2. Sealant: 70991 (47XJB) or other polyurethane sealant approved by Neogard.
   3. Epoxy (100% Solids): 70714/70715 (45060) clear.
   4. Neocrete SL mix (48012):
      a. Resin: 70800 (48019) series, gray.
      b. Hardener: 70801 (98010).
      c. Powder: Neocrete SL(70804) (66022).
   5. Fumed Silica: P1934 (D261).

6. Aggregate: Blended Silica Quartz 86364 (66030)
7. Topcoat: 12 mm Clear topcoat, 70817/70818

2.4 MATERIAL PERFORMANCE CRITERIA

A. Typical physical properties of cured Neocrete SL (70800/7801/70804) polyurethane used on this project are:
1. Compressive Strength: ASTM C579, 7,700 psi.
2. Tensile Strength: ASTM C307, 712 psi.
3. Flexile Strength: ASTM C580, 2,200 psi
4. Modulus of Elasticity: ASTM C580, 446,700 psi.
5. Shore D: ASTM D2240, 84
6. Adhesion to Concrete: ASTM D4541, 400 psi.
7. Water Resistance: ASTM C413, 0.42%
8. Density: ASTM C905-01, 121 lbs/ft3
9. Coefficient of Thermal Expansion: ASTM C531, 2.4 x 10-5 in/in deg F.
10. Resistance to Fungal Growth: ASTM G21, No Support of Growth.
11. Flammability: ASTM D635 Pass

2.5 ACCESSORIES

A. Miscellaneous materials such as cleaning agents, adhesives, closed cell backer rod, floor drains, and others shall be compatible with the specified system.

2.6 MIXING

A. Comply with manufacturer’s instructions for mixing procedures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that the work done under other sections meets the following requirements:
1. Concrete was cured for a minimum of 28 days (minimum of 3,500 psi compressive strength). The use of concrete curing agents, if any, shall be of the sodium silicate base only; other require written approval by manufacturer.
2. Damaged areas of concrete substrate to be restored to match adjacent areas. Use 70714/70715 epoxy and oven-dry silica aggregate approved by manufacturer for filling and leveling at a ratio of one part epoxy mixed with four parts aggregate by volume.
3. Moisture vapor emission of concrete substrate not to exceed 20 lbs/1,000 sq ft/24 hours, when tested by the quantitative calcium chloride test method (ASTM F1869). Relative Humidity is not to exceed 99% when tested by In-situ Probe Test (ATSM F2170).

3.2 PREPARATION

A. Cleaning: Substrate contaminated with oil or grease shall be vigorously scrubbed with a power broom and a strong non-sudsing detergent. Thoroughly wash, clean, and dry. Areas where oil or other contaminants penetrate deep into the concrete may require removal by mechanical methods. Do not apply materials unless surface is clean and dry.

B. Shot-Blasting: Mechanically prepare surface by shot-blasting to industry standard surface texture (ICRI's CSP3-4) without causing additional surface defects in substrate. Shot-blasting does not remove deep penetrating oils, grease, tar or asphalt stains. Proper cleaning procedures should be followed to ensure proper bonding of the deck coating. If shot-blasting is not practical, contact manufacturer for other methods of preparation.

C. Cracks: After shot-blasting, fill all non-moving cracks with 70614/70715 epoxy, mixed with P1934 fumed silica to form a paste. The mix ratio is one part 70714/70715 epoxy to 3 parts P1934 fumed silica by volume.

D. Control and Cold Joints: Fill control and cold joints flush with 70718/70719 flexible epoxy at ¾ inch depth. Install backer rod if necessary to limit depth to ¾ inch.

E. Expansion and Isolation Joints: Expansion and isolation joints =/< 1 inch width, shall be sealed with 70991 sealant. Sealant shall be applied to inside of joint only, not applied to floor surface.

F. Key Cuts: 1/8 inch – ¼ inch joints around perimeter floor, drains, penetrations, doorways, and in field of floor to mechanically anchor floor system.

3.3 APPLICATION

A. Factors That Affect Dry Film Thickness: Volume solids, thinning, surface profile, application technique and equipment, overspray, squeegee, brush and roller wet out, container residues, spills and other wastes are among the many factors that affect the amount of wet coating required to yield proper dry film thickness. To ensure that specified dry film thickness is achieved, use a wet mil gauge to verify actual thickness of wet coating applied, adjusting as needed for those factors which directly affect the dry film build.

B. Cementitous Polyurethane Mix:
   1. Pre-mixed 70800 for a minimum of one minute before mixing with 70801 hardener.
   2. To avoid color variation form mix to mix, scrape all of the pre-mixed 70800 from the 70800 can into the mixing container.
   3. Mix 141 fluid ounces of 70800 resin (contents of one 2-gallon) with 90 fluid ounces of 70801 hardner (contents of one 1-gallon can). Slowly add one 38-pound bag of 70804 powder to the resin mix. Mix with a variable speed drill utilizing a Jiffy Mixer to suspend any settled pigment and attain a uniform color. Continue mixing until the powder has been uniformly blended with the resin mix.
   4. Pour the cementitious polyurethane mix onto the floor and spread using a gauge rake. Immediately backroll with a spike roller to de-air and level the material.
   5. One unit of mixed material covers approximately 32 square feet at 3/16 inch thickness. Thickness and coverage rate can vary due to finish of substrate.

C. Aggregate: Immediately broadcast aggregate (blended silca quartz), evenly distributed, in wet cementitious polyurethane mix until refusal at a rate of approximately 40 pounds per 100 square feet. Make sure the aggregate is thrown into the air so it will fall vertically into the wet cementitious polyurethane mix, Maintain a 1 to 2 foot wet edge without any aggregate to allow for a smooth transition to the next application of cementitious polyurethane mix.

D. Allow to cure 6-10 hours at 70 degF/21 deg C before allowing foot traffic. After curing, remove excess aggregate and lightly sand with a circular floor sander and #50-60 grit sandpaper to remove any rough spots. All debris from sanding must be removed to provide a clean, moisture-free surface.

E. Neocrete SL Topcoat:
1.

F. Applicator is responsible for applying sufficient coating to the substrate.

3.4 CLEANING AND PROTECTION

A. Cleaning:

1. Remove debris resulting from completion of flooring operation from the project site.
2. Refer to manufacturer's Preventative Maintenance Manual for typical cleaning.
3. After completion of application, do not allow heavy traffic on coated surface for a period of at least 18 hours at 75 deg F/23 deg C.

END OF SECTION 096623

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Modular carpet tile.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for removing existing floor coverings.
2. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. 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 Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

C. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.8 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Lifetime Limited Warranty for Carpet Tiles:

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

a. Lifetime limited colorfastness to light.
b. 10 year colorfastness to atmospheric contaminants.
c. 10-year stain warranty.
d. Lifetime static.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Mohawk Group, “First One Up II”

1. Color: 988 Importance
2. Size: 24 by 24 inches (610 by 610 mm)
3. Backing Material: EcoFlex NXT
4. Fiber Type: ColorStrand SD Nylon
5. Dye Method: Solution Dyed
6. Soil-Resistance: EcoSEntry Plus
7. Installation Method: Quarter Turn
8. Construction: Tufted
9. Tufted Pile Weight: 22.00 oz/yd (746 g/m2)
10. Density: 9000.
11. Weight Density: 198000
12. Gauge: 1/12 (47.00 rows per 10 cm)
13. Stitches: 9.73 per inch (38.32 per 10 cm).
14. Foot Traffic Recommendation TARR: Severe
15. Flammability: ASTM E 648 Class 1
16. Smoke Density: ASTM E 662 Less than 450
17. Static Propensity: AATCC-134 Under 3.5 KV

B. Substitutions

1. Not Allowed

2.2 INSTALLATION ACCESSORIES

A. Moisture Mitigation System: Water-based roll-on copolymer moisture barrier

1. Basis of Design: Traxx Corp, LiquiShield 100
2. Or Approved Equal.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions. Gypsum-based underlayment products not allowed.

C. Concrete Substrates: 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 adhesive and carpet tile manufacturers.

D. Apply roll-on moisture barrier.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099000 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Site applied opaque paint coatings, except as otherwise noted.

B. Related Sections:

1. 055000 - Metal Fabrications: Pre-primed metal surfaces.
3. 081113 - Hollow Metal Doors and Frames: Pre-primed metal surfaces.
4. 099717 - High Performance Exterior Metal Coatings: Special coatings for exposed exterior steel fabrications.

1.2 REFERENCES

A. Master Painters Institute (MPI): Architectural Painting Specification Manual

B. Steel Structures Painting Council (SSPC).

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Materials List: Organize to indicate painting systems to be used with each substrate. Include manufacturer's product data as required to verify compliance with the specified requirements.

C. Samples:

1. Paint Samples:
   a. Submit three samples of each paint finish on an 8"x10" card. Reference manufacturer, type of paint, color, sheen, substrate, and application.
   b. Furnish additional samples until all paint finishes are approved.

D. Contract Closeout Submittals:

1. Record Paint Samples: In accordance with Section 017700, submit three 8"x10" samples of each paint and color used, indicating paint manufacturer and formula number; bind in identical sets. Deliver to on site location as directed.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in commercial painting and finishing with a minimum of three years documented experience.

B. Visual Standards: Each distinct area of the finished work shall be free of variations in color and sheen, orange peel, runs, sags, blistering, checking, cracking, scratches, dust, dirt, bugs, and other contaminants.

1.5 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 016000.

B. Delivery: Deliver paint materials to the jobsite in sealed, original, labeled containers, each bearing manufacturer's name, type of paint, brand name, color designation, and instructions for mixing and/or reducing.

C. Storage: Store paint materials at a minimum ambient temperature of 45 degrees F. in a well ventilated area.

D. Toxic, acidic, and combustible materials: Take all necessary precautionary safety measures as recommended by the material manufacturers and governing regulations.

E. Place. cotton waste, cloths, and material which may constitute a fire hazard in closed metal containers and daily remove from the site.

1.6 SITE CONDITIONS

A. Weather Conditions:

1. Do no exterior work on unprotected surfaces when raining, or other moisture is present or expected, or before applied paints can dry or attain proper cure.
2. Allow wetted surfaces to dry and attain temperatures and condition specified hereinafter before proceeding with previously started work.

B. Temperature:

1. Do no painting work when surface and air temperatures are below 40 degrees F or below those temperatures recommended by the manufacturer for the material type used.
2. Minimum temperatures for latex finishes: 45 degrees F for interior work and 50 degrees F. for exterior work, unless approved otherwise.

C. Lighting: Maintain a lighting level of minimum 50 foot-candles on the surfaces to be painted or finished.

D. Ventilation: Provide adequate continuous ventilation.

1.7 MAINTENANCE

A. Furnish overage of paint materials equal to 10 percent minimum of quantity of each paint and transparent finish system component, color and sheen required for the work, but furnish not more than five full one gallon cans, nor less than two full one quart cans, of each type. Overruns in excess of five gallons may be furnished to the Owner at the Contractor's option. Overage shall be taken from the batch mix furnished for the work. Overage shall be furnished in completely filled, properly labeled, sealed cans.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Interior Latex Paint Systems for Gypsum Board Substrate:

1. Glidden Professional:

a. Primer: LM9116 "Lifemaster" primer."

b. Finish: LM9300 "Lifemaster" Eggshell."

B. Interior Latex System for Metal Substrates - Semi-gloss:

1. Glidden Professional:

a. Metal Primer: "Devflex" 4020 DTM waterborne primer.

b. Finish: Devflex 4216 L HP High Performance Semi-gloss (Waterborne Acrylic).

C. Interior Latex System for Metal Substrates - Eggshell:

1. Glidden Professional:

a. Metal Primer: "Devflex" 4020 DTM waterborne primer.

b. Finish: Glidden Professional Ultra Hide 1411 Eggshell.

D. Interior Latex Dry-Fall System:

1. Glidden Professional:

a. Spot Primer: Glidden Professional 1482 Waterborne Eggshell Dry Fall.

b. Finish: Glidden Professional 1482 Waterborne Eggshell Dry Fall.

E. Epoxy Non-Slip Coating

a. Primer: American Safety MS~7CZ Heavy Duty Epoxy Primer for Non-Slip Coatings.

b. Finish: American Safety ASS-250 Heavy Duty Epoxy Non-Slip Coating.

F. Products for each general purpose shall be compatible. Each system shall be products of one manufacturer where ever possible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Perform adhesion tests on factory primed items. Notify the Owner's Construction Manager in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

3.2 MOISTURE CHECK

A. Check for excess moisture using an electronic moisture meter. Do not paint materials with moisture levels which would impair the bonding of finish coatings.

3.3 PROTECTION

A. Adequately protect surfaces not to be painted, from spills, drips, over painting, and other damage caused by this work. Include surfaces within the paint storage and preparation areas.

B. Hardware and Miscellaneous Items:

1. Remove electrical outlet and switch plates, mechanical diffusers, escutcheons, surface hardware, and fittings prior to starting work.
2. Store, clean and reinstall these items upon completion of work in each area. Use materials and techniques as necessary to prevent damage to finishes on such items.

3.4 SURFACE PREPARATION

A. General: Prepare surfaces by removing dirt, dust, grease, oil, moisture, and other contaminants which would impair finish adhesion.

B. Ferrous Metal Shop Primed under other Sections: Solvent clean to remove oil and grease. Remove loose rust and blistered and peeling paint to bare metal by scraping, sanding, and wire brushing in accordance with SSPC-SP2 and SP3. Immediately retouch damaged or abraded surfaces with compatible primer. Lightly sand all shop prime painted surfaces to receive paint finish.

C. Galvanized Ferrous Metal: Galvanized Surfaces: Prepare surfaces in accordance with ASTM D6386 as necessary to achieve sufficient profile for paint adhesion.

D. Unprimed Ferrous Metal:

1. Solvent clean in accordance with SSPC SP-1.
2. Commercial blast per SSPC SP6.

E. Existing Finished Surfaces To Be Repainted:

1. Existing Metal Surfaces:
   a. SSPC2 Manual/Hand Tool Cleaning followed by SSPC 1 Solvent Cleaning.
2. Remove loose, blistered, scaled, or crazed finishes to bare substrate; feather new work into existing work. Prepare surfaces to the nearest break line if necessary to blend new finishes with old finishes.
3. Wash and rinse surfaces with trisodium phosphate and water or other solution required to remove remaining film, wax, oil, grease, or foreign matter which would impair bond or cause bleed through. Thoroughly rinse trisodium phosphate from surfaces.
4. Lightly sand or apply a liquid deglosser on existing semi-gloss and high-gloss finishes before refinishing.
5. Perform an adhesion test on all existing surfaces to verify adhesion quality of the surface preparation.

3.5 GENERAL APPLICATION REQUIREMENTS

A. Unless specified or indicated otherwise, comply with requirements of MPI Architectural Painting Specification Manual.

B. Unless specified or indicated otherwise, follow paint manufacturer's label directions for general application procedures and coverage rates.

C. Do not apply finishes on surfaces that are not sufficiently dry. Make sure each coat of finish is dry and hard before a following coat is applied unless the manufacturer's directions state otherwise.

D. Tint filler to match stain when clear finishes are specified; work filler well into grain and, before it has set, working perpendicularly to the grain, wipe the excess from the surface.

E. Opaque Finishes:

1. Apply number of coats scheduled for each application, except that additional finish coats shall be applied as necessary for complete hiding of substrate colors.
2. Apply primer coats untinted. Where more than one coat of paint is required, tint each succeeding coat up to the final coat similar in tint, but slightly lighter in value (shade).
3. Sand lightly between coats if necessary to achieve required finish.

F. Rollers for application and backrolling of latex paints shall have a nap of 3/8 inch or less.

G. Where roller texture is scheduled for application to gypsum board surfaces, finish coats may be roller applied, or spray applied and back rolled at Contractor's option.

H. Factory Primed Surfaces: Apply scheduled finish system, less primer coat, except as necessary for patching damage to factory prime coating.

I. Do not apply paint to the following surfaces:

1. Pre-finished metal.
2. Labels and adhered operating instructions.
3. Floor finishes such as tile, resilient flooring, polished concrete and other specially applied floor finishes.
4. Prefinished ceilings.
5. Light fixtures and trim.
6. Switches and outlets electrical controls and covers.
7. Prefinished diffusers and return air grilles.
8. Sprinkler heads.

3.6 INTERIOR PAINTING AND FINISHING SYSTEMS

A. Gypsum Board - Latex System:

1. System: Three coats - first coat latex primer sealer (untinted), second and third coat latex paint.

2. Sheen: Roller texture, eggshell sheen.
3. Surfaces: Use on all exposed gypsum board surfaces.

B. Ferrous Metal - Acrylic System - Semi-gloss:

1. System: Three coats; first coat acrylic DTM primer; second and third coats latex finish. The primer may be omitted at previously primed or painted surfaces, except as necessary to recoat damaged or abraded coatings.
2. Sheen: Semi-gloss, unless indicated otherwise.
3. Surfaces: Interior ferrous metal surfaces including, without limitation, the following:
   a. Existing and new interior structural steel columns.
   b. Existing stair framing assemblies.
   c. Access doors and panels.

C. Ferrous Metal - Acrylic System - Eggshell:

1. System: Three coats; first coat acrylic DTM primer; second and third coats latex finish. The primer may be omitted at previously primed or painted surfaces, except as necessary to recoat damaged or abraded coatings.
2. Sheen: Eggshell, unless indicated otherwise.
3. Surfaces: Interior ferrous metal surfaces including, without limitation, the following:
   a. Existing interior exposed metal siding.

D. Ferrous Metal- Epoxy System - Non-Slip Coating

1. System: Apply Primer to a minimum 2-3 mils (50-75 microns) dry film thickness above the averaged surface profile per manufacturer's recommendations. Apply Finish coat per manufacturer's recommendation.
2. Surfaces: Stair treads and floor surface of mezzanine.

3.7 CLEANUP

A. As the work proceeds and on completion of the work, promptly remove all sealers, primers, paints and finishes where spilled, splashed or splattered in a manner not to damage the surface from which it is removed.

B. Remove masking.

C. Clean, or replace with new, all lamps and electrical fixtures damaged by overspray; replace with new identical components all lighting fixture louvers and reflectors damaged by overspray.

3.8 COLOR SCHEDULE

A. Provide colors and sheens as selected by the Architect. Request color samples for matching

END OF SECTION 099000

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes but is not limited to surface preparation and the application of high-performance coating systems to the following interior/exterior Work:
   1. Metal finish coating on structural and non-structural steel.
   2. Preparation of surfaces, and
   3. Application to surfaces of metal fabrications, flashings and the like metal

1.3 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
   2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 QUALITY ASSURANCE

A. Qualification of Workers: Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all Work performed under this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated
3. Products shall be of same manufacturer for each coat in a coating system.

2.2 MANUFACTURERS

A. Basis of Design: Tnemec Company

B. ICI/Devoe.

C. Or Approve Equal.

2.3 MATERIALS

A. Galvanized Surfaces:
1. First Step: Spray Pretreatment: Tnemegrip No. 32-1210 (Prime)
2. Coatings:
a. Hi-Build No. 66-1211.
b. Finish: Hi-Build No. 71 (Semi-Gloss) as selected.

B. Non-Galvanized Surfaces:
1. Series 66
2. System 701

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

C. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.

D. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 HIGH-PERFORMANCE COATING SCHEDULE

A. Galvanized Surfaces:
   1. First Step: Spray Pretreatment: Tnemegrip No 32-1210 (Prime)
   2. Coating:
      a. Hi-Build No. 66-1211
      b. Finish: Hi-Build No. 71 (Semi-Gloss)

B. Non-Galvanized Surfaces:
   1. Series 66
   2. Series 73
   3. Series 701

END OF SECTION 099600

SECTION 099717 – HIGH PERFORMANCE EXTERIOR METAL COATINGS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. High performance coatings system for exterior metal.
2. Schedule of finishes at the end of the section.

B. Related Sections:

1. 051200 - Structural Steel Framing: Shop application of primer.
2. 055000 – Miscellaneous Metal Fabrications: Shop application of primer.

1.2 REFERENCES

A. Steel Structures Painting Council (SSPC) "Steel Structures Painting Manual, Volume 2, Systems and Specifications."

1.3 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Manufacturer's Literature: Descriptive product data including recommendations for mixing, thinning, application and curing. Include recommended coating thicknesses.

C. Samples: For each finish system and color combination, submit a sample prepared by the applicator in accordance with the manufacturer's printed instructions. The sample shall represent the degree of specular gloss and color. Mask the sample progressively as necessary to show the undercoats.

1.4 QUALITY ASSURANCE

A. Applicator: Company specializing in shop application of special coatings with three years minimum experience.

B. Each paint system shall consist of the products from a single manufacturer.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Apply coating only under the following prevailing conditions:

1. Air and surface temperatures between 50 degrees F and 100 degrees F.
2. Relative humidity below 85 percent and surface temperature of substrate at least 5 degrees F above the dew point.

B. Protect all surfaces not indicated to be coated.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in accordance with Section 016000.

B. Store materials in protected area of a temperature between 40 and 110 degrees F.

C. Product shall be used within 12 months from the date shipped from the manufacturer.

1.7 WARRANTY

A. Submit in accordance with Section 017700.

B. Provide special five year warranty from time of application of field coatings, and from time of installation of shop finished components, against failure of coating materials to perform in accordance with specified requirements, and in accordance with the product data sheets.

1.8 MAINTENANCE

A. Furnish quantity of paint equal to 5 percent minimum of quantity of primer and each color and gloss of coating materials required for the work, but not more than five one-quart cans, nor less than two one-quart cans, of each. Overruns in excess of five quarts may be furnished to the Owner at the Contractor's option. Furnish finish coating materials taken from the batch mix furnished for the work in completely filled, properly labeled and sealed cans. Furnish proper proportion ofcatalyst, as applicable, for extra stock.

PART 2 - PRODUCTS

2.1 HIGH PERFORMANCE PAINT SYSTEMS

A. Steel Surfaces - Zinc/Epoxy/Polyurethane System:

1. VOC Less than 100 giL.
2. Approved Devoe Products:
   a. Zinc Primer: Cata Coat 302H zinc rich primer.
   b. Epoxy Intermediate Coat: Devoe Devran 224 HS Epoxy.
   c. Polyurethane Finish Coat: Devoe Devthane 378 Semi Glossheen.

B. Factory Primed Metal Surfaces - Epoxy/Polyurethane System:

1. VOC Less than 100 giL.
2. Where specified primer is incompatible with factory primed coatings, provide manufacturer recommended tie coat.
3. Approved Devoe Products:
   a. Epoxy Intermediate Coat: Devoe Devran 224 HS Epoxy.
   b. Polyurethane Finish Coat: Devoe Devthane 378 Semi Glossheen.

2.2 MATERIAL PREPARATION

A. Mix and thin materials according to manufacturer's current printed instructions.

B. Do not use mixed material beyond manufacturer's recommended pot life.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine surfaces to be coated and report any conditions that would adversely affect the appearance or performance of the coating system and which cannot be put into acceptable condition by the preparation work specified herein.

B. Commencement of application constitutes installer's acceptance of substrate conditions.

3.2 SURFACE PREPARATION

A. Surface Preparation by Material:

1. Steel Surfaces: Commercial blast per SSPC SP6.
2. Factory Primed and Factory Finished Surfaces: Sand per SSPC SP2.
3. Galvanized Surfaces: Prepare surfaces in accordance with ASTM D6386 as necessary to achieve sufficient profile for paint adhesion.

B. Surfaces shall be made clean, dry and free of oil, grease and other contaminants, prior to finish coat application.

3.3 APPLICATION

A. Apply coatings in accordance with the manufacturer's recommendations.

B. Spray apply all coatings unless approved otherwise.

C. Apply for complete coverage, including contact surfaces and penetrations for fasteners. Double spray at sharp corners and edges in order to maintain adequate millage.

D. Primer may be omitted at items Shop-primed under other Sections with the same primer specified herein.

E. Shop apply primers, and field apply remaining coatings unless approved otherwise.

3.4 REPAIR

A. Shop Primed Surfaces: Repair damage to coatings using materials and systems similar to originally applied primer.

B. Repair surfaces immediately after damage has occurred to the coating. Maintain a minimum of one prime coat on all surfaces at all times during construction.

3.5 FIELD QUALITY CONTROL

A. System Appearance: All coatings, when cured, shall be visibly free of dust, dirt, flow lines, streaks, sags, holidays, blisters, pinholes, runs, curtains or other surface imperfections.

B. Unacceptable Finishes: Unacceptable color or film characteristics shall be cause for

rejection of the entire coated section. Components with unacceptable finishes shall be replaced by another factory applied coated component. Determination of such conditions and final approval will be made by the Architect.

3.6 PROTECTION

A. Protect coated surfaces from damage until Substantial Completion.

B. Retouch all damaged surfaces, including fasteners, using same procedure and materials specified for coating.

3.7 SCHEDULE

A. Steel Surfaces - Zinc/Epoxy/Polyurethane System:

1. Apply one prime coat, one intermediate coat, and one top coat.
2. Apply to the following surfaces:
    a. Exposed exterior steel elements.

B. Steel and Galvanized Surfaces - Epoxy/Polyurethane System:

1. Apply one prime coat, and one top coat.
2. Apply to the following surfaces:
    a. Exterior surfaces of pre-primed metal stairs and railings.

3.8 COLORS

A. Provide colors and sheens as selected by the Architect.

END OF SECTION 099717

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Panel signs.
2. Relief wall graphics (Lobby)

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.3 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Panel signs.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Company specializing in manufacturing the products specified in this section with a minimum of three (3) years of documented experience.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

A. Panel Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Aluminum Composite Material (ACM: Aluminum sheet laminated to both sides of polyethlyene core.

a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
b. Surface-Applied, Flat Graphics: Applied vinyl film.

2. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition: Square cut.

3. Mounting: Manufacturer's standard method for substrates indicated projecting from wall.
4. Surface Finish and Applied Graphics:

a. Integral Aluminum Finish: Clear anodized.
b. Painted Finish and Graphics: Manufacturer's standard, factory-applied exterior-grade sign paint.
Photo-Image Graphics: Manufacturer's standard multicolor 600-dpi halftone or dot-screen image.

5. Flatness Tolerance: Sign is to remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

2.2 PANEL-SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 RELIEF WALL GRAPHICS (LOBBY)

A. Panel Product: MDF

B. Thickness: ¼ inch (6 mm)

C. Fabrication:
1. Laser-cut image supplied by Architect in .ai., .dwg, or dfx file format.

D. Fabricators:
1. Laser Fremont; 912 NW 50th St, Seattle, WA; 206 390-5752; www.laserfremont.com
2. Or Equal.

E. Anchorage:
1. Screws and/or adhesives, as recommended by fabricator.

F. Surface/Seam Filler:
1. Two-part resin with hardener, permanent, non-shrinking, paintable and sandable.
a. 3M Bondo Wood Filler, or similar

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish nonferrous-metal devices unless otherwise indicated.
3. Sign Mounting Fasteners:
a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.

b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

4. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.

B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, as appropriate for the substrate.

1. Uses: Securing signs with imposed loads to structure.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).

C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Stainless Steel Brackets: Factory finish brackets with No. 4 finish unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 101423 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three (3) years of documented experience.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer. Maintain this minimum temperature during and after installation of signs.

PART 2 - PRODUCTS

2.1 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Manufacturers:
      a. Architectural Signing, Inc. (ASI)
      b. Spanjer Brothers Inc.
      c. Or Equal
   2. Laminated-Sheet Sign: High impact acrylic/PVC thermoplastic alloy, pressure molded
      a. Colors: Selected from manufacturer’s standard range of colors.
      b. Composite-Sheet Thickness: 0.25 inch (6.35 mm).
   3. Tactile Graphics and Text: Provide tactile copy and grade 2 braille raised 1/32 inch minimum from sign face using manufacturer’s co-molding process.
      a. Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant ADA regulations and requirements indicated for size, style, spacing, content, position, and colors.

   4. Sign-Panel Perimeter: Finish edges smooth.
      a. Edge Condition: Square cut .
      b. Corner Condition in Elevation: Square.

   5. Mounting: Manufacturer's standard method for substrates indicated with concealed anchors.

2.2 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.3 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423.16

SECTION 102113 - METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal toilet compartments.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for blocking.
2. Section 092216 "Non-Structural Metal Framing" for blocking.
3. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Metal toilet compartments.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show bracing locations.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For toilet compartments.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain metal toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf (1112 N) applied at any direction and at any point, without deformation of panel.

C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.3 METAL TOILET COMPARTMENTS

A. Manufacturers:

1. ASI Global Partitions.
2. Bradley Corporation.
3. Or Approved Equal

B. Toilet-Enclosure Style: Floor Anchored/Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Tension leveled, cold-rolled galvannealed steel face sheet, bonded under pressure to honeycomb core with non-toxic adhesive.

E. No-Sight System: Integral to door construction required.

1. Powder coated to match partition color concurrent with fabrication.
2. Add on no sight strips not allowed.

F. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.

1. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand specified structural performance requirements.
2. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

G. Urinal-Screen Construction:

1. Urinal Screen: Matching panel construction.

H. Facing Sheets and Closures: Electrolytically coated steel sheet with nominal base-metal (uncoated) thicknesses as follows:

1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).
2. Panels: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
3. Doors: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
4. Urinal Screens: Thickness matching panels.

I. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

J. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

K. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; chrome-plated zamac.

2. Full-Height (Continuous) Type for Urinal Screens: Manufacturer's standard design; aluminum.

L. Steel Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Apply one color in each room.

1. Color: As selected by Architect from manufacturer's full range.

2.4 HARDWARE AND ACCESSORIES

A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories.

1. Hinges:

a. Manufacturer's gravity-actuated, cam-action, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.

1) Material, Gravity-Type Hinge: Chrome-plated zamac.

2. Latch and Keeper: Manufacturer's recessed, with occupancy indicator latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.

    a. Material: Manufacturer's standard.

3. Coat Hook: Manufacturer's combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.

    a. Material: Manufacturer's standard.

4. Door Bumper: Manufacturer's rubber-tipped bumper at out-swinging doors.

    a. Material: Manufacturer's standard.

5. Door Pull: Manufacturer's unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.

    a. Material: Manufacturer's standard.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.

B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet enclosures and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch (13 mm).

2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102113.13 - METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal toilet compartments.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for blocking.
2. Section 102800 "Toilet and Bath Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Metal toilet compartments.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show bracing locations.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For toilet compartments.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain metal toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

B. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:

1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf (1112 N) applied at any direction and at any point, without deformation of panel.

C. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1 for toilet compartments designated as accessible.

2.3 METAL TOILET COMPARTMENTS

A. Manufacturers:

1. ASI Global Partitions.
2. Bradley Corporation.
3. Or Approved Equal

B. Toilet-Enclosure Style: Floor Anchored/Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Tension leveled, cold-rolled galvannealed steel face sheet, bonded under pressure to honeycomb core with non-toxic adhesive.

E. No-Sight System: Integral to door construction required.

1. Powder coated to match partition color concurrent with fabrication.

2. Add on no sight strips not allowed.

F. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.

1. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand specified structural performance requirements.
2. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

G. Urinal-Screen Construction:

1. Urinal Screen: Matching panel construction.

H. Facing Sheets and Closures: Electrolytically coated steel sheet with nominal base-metal (uncoated) thicknesses as follows:

1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch (0.91 mm).
2. Panels: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
3. Doors: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
4. Urinal Screens: Thickness matching panels.

I. Pilaster Shoes: Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

J. Pilaster Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

K. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; chrome-plated zamac.

2. Full-Height (Continuous) Type for Urinal Screens: Manufacturer's standard design; aluminum.

L. Steel Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Apply one color in each room.

1. Color: As selected by Architect from manufacturer's full range.

2.4 HARDWARE AND ACCESSORIES

A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories.

1. Hinges:

a. Manufacturer's gravity-actuated, cam-action, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.

1) Material, Gravity-Type Hinge: Chrome-plated zamac.

2. Latch and Keeper: Manufacturer's recessed, with occupancy indicator latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.

a. Material: Manufacturer's standard.

3. Coat Hook: Manufacturer's combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.

a. Material: Manufacturer's standard.

4. Door Bumper: Manufacturer's rubber-tipped bumper at outswinging doors.

a. Material: Manufacturer's standard.

5. Door Pull: Manufacturer's unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.

a. Material: Manufacturer's standard.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.5 FABRICATION

A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.

B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, inswinging doors for standard toilet enclosures and 36-inch- (914-mm-) wide, outswinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for toilet enclosures designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels or Screens: 1/2 inch (13 mm).

2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 102113.13

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bullet Resistant Panels

1.2 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM E119-98 Standard Test for One-Hour Fire Rating of Building Construction and Materials
   2. ASTM F1233-98 Standard Test Method for Forced Entry Testing of Materials/Assemblies, Class IV
   3. International Organization for Standardization:
      a. ISO 9001:2015 Quality Management System
   4. National Institute of Justice Ballistic Standards:
      a. NIJ Standard 0108.01 – Type III-A
   5. Small Business Administration:
      a. SBA Small Business Size Standard
   6. Underwriters Laboratories:
      a. UL 752 Specifications and Ammunition, 11th Edition, Standard for Bullet Resisting Equipment published September 9, 2005, revised December 21, 2006, Level 3
   7. The United States Department of State:
      a. The International Traffic in Arms Regulations (ITAR)

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Certificates: Submit certificate to indicate compliance with UL Listing Verification and UL 752 Current Test Results as provided by Underwriters Laboratories.

1.4 DELIVERY, HANDLING, AND STORAGE

A. Deliver materials to project with manufacturer’s UL LISTED Labels intact and legible.

B. Handle material with care to prevent damage. Store materials inside under cover, stack flat and off the floor.

C. WARRANTY
1. Warrant all materials and workmanship against defects for a period of ten (10) years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: ArmorCore by Waco Composites, Waco TX 76710, 254 752-3622, www.armorcore.com

B. Covenant Security Equipment, Phoenix, AZ , phone: 866-286-4400

C. Or Approved Equal

2.2 PERFORMANCE REQUIREMENTS

A. Bullet Resistant Fiberglass Panels shall be “non ricochet type” to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.

B. Panel Rating: UL752 Level 3.

C. Bullet resistance of joints: equal to that of the panel

2.3 MATERIALS

A. Panels fabricated of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets

B. Thickness: 7/16 inch nominal thickness.

C. Nominal Weight: 4.8 lbs. per sq. ft.

D. Panel Sizes: 4 feet by 8 feet

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting installation, verify work of related trades required in contract documents and architectural drawings is complete to the point where work of this Section may properly commence .

3.2 JOINTS

A. Reinforce joints with a back-up layer of bullet resistive material. Minimum width of reinforcing layer at joint shall be 4-inches, centered on panel joints .

3.3 APPLICATION

A. Install armor in accordance with manufacturer's recommendations and as required by contract documents.

B. Secure armor panels using screws, bolts, or an industrial adhesive.
   1. Method of application shall install panels minimizing vulnerabilities by fitting tightly to adjacent surfaces including concrete floor slab, concrete roof slab, bullet resistive door frames, bullet resistive window frames, and the like.

END OF SECTION 102641

SECTION 102800 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Washroom accessories.
2. Shower room accessories.
3. Childcare accessories.
4. Underlavatory guards.
5. Custodial accessories.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: **15** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer’s names and catalogue numbers listed establish the standard of quality required, but are not restrictive.

B. Similar and equal products of other manufacturers maybe be submitted for approval of the Architect under provisions of Section 012500 Substitutions.

2.2 MATERIALS, GENERAL

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gauge (0.34 inch) minimum, unless otherwise indicated.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed. Partition mounted accessories to be though-bolted back-to-back.

C. Tamper-proof screws and attachments.

D. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC2.

E. Locks changeable to Snohomish County standard. Each accessory to be CAT74 provided by Contractor. Sanitary napkin coin box and sharps disposal shall be keyed to FAB11.

2.3 TOILET ACCESSORIES

A.

B. Toilet Tissue (Roll) Dispenser:
   1. Basis of Design: Toilet paper holders shall be partition or surface mounted dual jumbo toilet paper dispener, Coreless spindle. Lockable.
   2. Manufacturer:
      a. American Specialties Inc. (ASI) 0039
      b. Bobrick B-5425
      c. Or Approved Equal

C. Paper Towel (Folded) Dispenser:
   1. Basis of Design: Surface mounted paper towel dispenser for C-Fold paper towels.
   2. Manufacturer:
      a. American Specialties Inc. 0210
      b. Bobrick B-9262
      c. Or Approved Equal

D. Waste Receptacle:
   1. Basis of Design: Surface mounted waste receptacle.
   2. Manufacturer:
      a. American Specialties Inc. 0826
      b. Bobrick B-277
      c. Or Approved Equal

E. Recessed Sanitary Napkin Dispenser:
   1. Sanitary napkin dispenser, both tampons and napkins. Charge $0.25 each. Thirty napkins and twenty eight tampons. Lockable. Fully recessed. Key and lock. Keyed to FAB11 coin box and CAT 74 for product refill.
   2. Manufacturer:
      a. American Specialties Inc. 0468-25
      b. Bobrick B-4017
      c. Or Approved Equal

F. Sanitary Napkin Receptacle
   1. Stainless steel sanitary napkin receptacle surface mounted, Capacity 1.2 gal.
   2. Manufacturers:
      a. American Specialties Inc 20852
      b. Bobrick B-224
      c. Or Approved Equal.

G. Mop Shelf
   1. Stainless steel, wall mounted, located in Janitor Closet.
   2. Manufacturers:
      a. Advance Tabco, K245-24
      b. American Specialties Inc 1315-4
      c. Bobrick B-224
      d. Or Approved Equal.

H. Toilet Seat Cover Dispenser
   1. Toilet Seat Cover Dispenser, surface mounted. Dispenses 250 seat covers. 22 gauge Type 304 stainless steel.
   2. Manufacturers:
      a. American Specialties Inc 0477-SM

b. Bobrick B-221
c. Or Approved Equal.

I. Sharps Disposal Cabinet
1. 304 Stainless Steel, 22 gauge door and cabinet.
2. Accommodates (1) Becton, Dickerson and Co. sharps collector Model No. 305443
3. Fully recessed, lockable. Lock: FAB 11
4. Manufacturers:
a. American Specialties Inc 0548
b. Bobrick B-35016
c. Or Approved Equal.

J. Grab Bars
1. Stainless Steel Grab Bars: Design grab bars and attachments to resist 250 lb (0.22 kN) concentrated load applied at any point in any direction with safety grip finish and brusjed ends with concealed anchor plates. Meet or exceed CABO/ANSI A117.1
2. Manufacturer:
a. American Specialties Inc 3800-P Series
b. Bobrick B-6806
c. Or Approved Equal.

K. Liquid-Soap Dispenser
1. Impact resistant ABS push button and spout. Translucent ABS container. Concealed locking device.
2. Manufacturers:
a. American Specialties Inc 0340
b. Bobrick B-40
c. Or Approved Equal.

L. Surface Mounted Baby Changing Station
1. Stainless steel, Type 304 with No. 4 finish with concealed pneumatic cylinder and hinge structure. Unit to conform to ICC A117.1 2009 Accessible and Usable Building and Facilities, ASTM F2285-04 Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use, ANSI Z535.4 Product Safety Signs and Labels, and ASTM G21 Antifungal Standards, or local code if more stringent installation requirements are applicable for barrier free accessibility.
2. Manufacturers:
a. American Specialties Inc 9013-9
b. Bobrick KB110-SSWM
c. Or Approved Equal.

2.4 UNDERLAVATORY GUARDS

A. Underlavatory Guard:
1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
2. Material and Finish: Antimicrobial, molded plastic, white.

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 ASTM F446.

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 instructions.

END OF SECTION 102800

SECTION 104400 - FIRE PROTECTION SPECIALTIES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire extinguishers.
2. Mounting brackets.

1.2 REFERENCES

A. National Fire Protection Association (NFPA): NFPA10" Portable Fire Extinguishers.

B. Underwriter's Laboratory (UL).

1.3 QUALITY ASSURANCE

A. Conform to NFPA 10 requirements for extinguishers.

B. Provide fire extinguishers from a single manufacturer.

1.4 SUBMITTALS

A. Make submittals in accordance with Section 013300.

B. Product Data: Submit product literature for fire extinguisher brackets, and each type of extinguisher proposed for the work.

C. Contract Closeout Submittal: Submit manufacturer's operation and maintenance data under provisions of Section 017700. Include test, refill or recharge schedules, procedures, and recertification requirements.

D. Submittal requirements, in ADDITION to Section 013300:

1. Submittals are subject to reviews and approval by:
   a. Boeing Fire Protection Engineering.
   b. Factory Mutual (FM).
   c. Industrial Risk Insurers (lRI).
2. Copies required: Where paper copies are required, submit 5 additional copies.
3. Review time: Allow additional 15 days.
4. Boeing Fire Protection Engineer will make all submittals to FM and IRI.
5. Coordinate submittals with the submittals other fire protection sections so that all Fire Protection systems may be submitted to FM and IRI at one time:

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS (FE)

A. Manufacturer:

1. Provide all extinguishers from Amerex Corporation, Tel. (206) 241-5909 or (206) 632-2360.
2. Substitution: NOT PERMITTED

B. UL listed and FM approved for intended use.

C. Types:

1. Type 1 - General Purpose: Dry Chemical, 6 pound, 3A-40B:C. Rechargeable.

2.2 ACCESSORIES

A. Fire Extinguisher Brackets: Wall mount type, appropriate to the size of the extinguisher, equipped with strap and quick release clip.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Owner's Construction Manager, in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of conditions as satisfactory.

C. Verify blocking is in place.

3.2 INSTALLATION

A. Where fire extinguishers are indicated for wall mounting, secure bracket to wall through finish to framing or blocking.

B. Fire extinguishers shall be installed, charged, tagged, and dated, not more than 30 days prior to Substantial Completion.

C. Fire extinguishers shall be placed so as to comply with the travel distance requirements of NFPA 10 for the occupancy classification of the building.

END OF SECTION 104400

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104400 "Fire Protection Specialties" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Product Schedule: For fire-protection cabinets. Indicate whether semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   1. Manufacturers:
      a. Basis of Design: JL Industries, “Cosmopolitan” Series.
      b. Larsen’s Manufacturing Company.
      c. Or Approved Equal.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.

   1. Shelf: Same metal and finish as cabinet.

D. Recessed Cabinet:
   1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.

F. Cabinet Trim Material: Same material and finish as door.

G. Door Material: Aluminum sheet

H. Door Style: Fully glazed panel with frame.

I. Door Glazing: Tempered float glass (clear).

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

   1. Provide projecting lever handle with cam-action latch.
   2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.

K. Accessories:

   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location

    a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

        1) Location: Applied to cabinet door.
        2) Application Process: Pressure-sensitive vinyl letters.
        3) Lettering Color: Red.
        4) Orientation: Vertical.

L. Materials:

1. Aluminum: ASTM B221 (ASTM B221M) for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.

    a. Finish: Clear anodic.
2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear)

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. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames and grind smooth.

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 AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed and 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.

1. Fire-Protection Cabinets: 42 inches (1067 mm) above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

a. Install cabinet with not more than 1/16-inch (1.6-mm) tolerance between pipe OD and knockout OD. Center pipe within knockout.
b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

C. Identification:

1. Apply vinyl lettering at locations indicated.

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 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Evidence Storage Lockers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: For metal lockers.

   1. Include plans, elevations, sections, and attachment details.
   2. Show locker trim and accessories.
   3. Include locker identification system and numbering sequence.

C. Samples: For each color specified, in manufacturer's standard size.

D. Samples for Verification: For the following products, in manufacturer's standard size:

   1. Lockers and equipment.
   2. Locker benches.

1.3 QUALITY ASSURANCE

A. Provide each type of metal locker as produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.

B. Seismic Performance: Provide Welded Metal Lockers capable of withstanding the effects of earthquake movement when required by applicable building codes.

C. Installer: Minimum 1 year experience installing commercial quality work. Manufacturer’s authorized representative for the specified products for installing welded metal lockers.

D. Sample Warranty: For special warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Protect locker finish and adjacent surfaces from damage.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.6 WARRANTY

A. Provide a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units, which fail in materials or workmanship with the established warranty period.

B. Limited Lifetime Warranty: Subject to the terms in the written warranty, warrant the original purchaser exclusively that the locker frames manufactured by it will be free from defects in materials and workmanship for the lifetime of the locker

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Spacesaver Corporation, 1450 Janesville Ave Fort Atkinson, Wisconsin 53538, 800 492-3434

B. Tiffin Metal Products Company, 450 Wall St Tiffin OH 44883, 800 537-0983

2.2 LOCKER TYPE

A. Non Pass-thru Evidence Lockers.

2.3 MANUFACTURED COMPONENTS

A. Welded Frame:
   1. The welded frame is structural and shall consist of top, bottom, back, and sides constructed of a minimum of 18 gage (1.21 mm) steel. All frame components shall be joined using resistance welding. Riveting or bolting of structural members will not be permitted.
   2. Horizontal and vertical outer front flanges will be a minimum of 1.5 inches (38 mm). Horizontal and vertical flanges will overlap with a minimum of 2 resistance welds per corner.
   3. Center vertical lock housing is structural and will run the full height and depth of the locker. All locks will be completely enclosed by a full height removable panel. Provide engagement points for anti-pry table that are on all front doors.
   4. Exposed lock mechanisms that can snag evidence and be obstructed by stored articles will not be permitted.

B. Welded Bases
   1. Each welded base shall be permanently affixed to each locker using modern Inert Gas Metal Arc Welding techniques for lateral stability. The base shall be a minimum of 14 gage (1.98 mm) steel 4 inches (101 mm) high with a 1.5 inch (38 mm) return on the bottom for support.
   2. Provide four 0.375 inch (9.5 mm) mounting holes and four 0.375 (9.5 mm) nuts welded in place for the mounting of floor levelers. Provide four appliance levelers per locker.
   3. Provide removable access panels for access to mounting holes and leveling points.

C. Shelves
   1. Shall be a single-piece formed from a minimum of 18 gage (1.21 mm) cold rolled steel with a double 90-degree bend on the rear of the shelf and a double 90-degree bend on the front of the shelf. Shelf sides shall be turned up 90-degrees for ease of cleaning and to prevent debris from becoming caught between the shelf and sidewall.
   2. All shelves shall be welded into place. Rivets, screws, bolts or other loose fasteners will not be permitted for the fastening of shelves to the locker frame.

D. Locks
   1. Locks shall be a one-piece removable design. Locks will secure the door with a single push of a button with no other action required by the user.
   2. Locks will be deadbolt type locks with multi point engagement. Rotary latches or cam locks not permitted.
   3. Locks will be reset from the front of the locker using tube type locks keyed to differ.
   4. Provide documentation for cycle testing where locks are tested successfully to a minimum 40,000 cycles without failure.

E. One Piece Welded Doors
   1. Shall be formed from two pieces of minimum 18 gage (1.2 mm) cold rolled steel box formed and welded together using modern GMAW techniques. The one piece door with inner and outer door skins shall have a combined steel thickness of no less than 0.096 inches (2.4 mm) thick.
   2. Each door shall have a nickel plated, flush mounted door handle installed with fasteners visible only in the unlocked position.
   3. Provide neoprene silencers on each door.
   4. Provide anti-pry tabs that engage with the center vertical lock housing when the door is locked.
   5. Doors shall have no moving parts except the door and the hinge.
   6. Provide stainless steel spring loaded hinges that are welded to prevent pin removal. Spring loaded hinges shall be capable of holding the door closed and flush with the door frame. Doors that hang ajar are a safety concern and will not be permitted.

2.4 FABRICATION

A. General: Coordinate fabrication and delivery to ensure no delay in progress of the Work.

2.5 FINISHES

A. Colors: Selected from manufacturer’s standard available colors.

B. Paint Finish: Provide factory applied electrostatic powder coat paint. Meet or exceed specifications of the American Society for Testing and Materials (ASTM) standards.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. 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 locker manufacturer.

END OF SECTION 105113

SECTION 119812 - DETENTION DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Detention doors.
2. Detention frames.

B. Related Requirements:

1. Section 087100 "Door Hardware".

1.2 DEFINITIONS

A. Minimum-Thickness Steel: Indicated as the specified minimum thicknesses for base metal without coatings, in accordance with NAAMM-HMMA 803.

1.3 COORDINATION

A. Coordinate installation of anchorages for detention 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 adjacent construction. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, label compliance, and finishes for each detention door and frame type specified.

B. Shop Drawings: In addition to requirements below, provide a schedule using same reference numbers for details and openings as those on Drawings:

1. Elevations of each door type.
2. Direction of swing.
3. Inmate and non-inmate sides.
4. Details of doors, including vertical and horizontal edge details, and metal thicknesses.
5. Details of frames, including dimensioned profiles, and metal thicknesses.
6. Locations of reinforcement and preparations for hardware.
7. Details of each different wall opening condition.
8. Details of anchorages, joints, field splices, and connections.
9. Details of cuff ports.

10. Details of moldings, removable stops, and glazing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Product Test Reports: For each type of detention hollow-metal door and frame assembly including vision and side lights, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver detention hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver detention frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store detention hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6.3-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Titan Metal Products, 1891 Wardrobe Ave, Merced CA 95341, 866 848-2667
2. Ceco Door, an Assa Abloy company, 9159 Telecom Drive, TN, 888 264-7474.
3. Or Approve Equal.
4. Source Limitations: Obtain detention doors and frames from single source from single manufacturer.

2.2 MATERIALS – DOORS AND FRAMES

A. Detention rated doors and frames meeting ASTM F1450 Grade 4 and ASTM F1577 as specified. Detention rating of glazing must meet ASTM F1915 Grade 4 as specified.

2.3 DETENTION DOORS

A. General: Provide flush-design detention doors of seamless hollow construction, 2 inches (51 mm) thick unless otherwise indicated. Construct detention doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges.

1. For single-acting swinging detention doors, bevel both vertical edges 1/8 inch in 2 inches (3 mm in 51 mm).

B. Core Construction: Provide the following core construction of same material as detention door face sheets, welded to both detention door faces:

1. Steel-Stiffened Core: 0.042-inch- (1.0-mm-) thick, steel vertical stiffeners extending full-door height, with vertical webs spaced not more than 4 inches (102 mm) apart, spot welded to face sheets a maximum of 3 inches (76 mm) o.c. Fill spaces between stiffeners with insulation.

C. Vertical Edge Channels: 0.123-inch- (3.1-mm-) thick, continuous channel of same material as detention door face sheets, extending full-door height at each vertical edge; welded to top and bottom channels to create a fully welded perimeter channel. Noncontiguous channel is permitted to accommodate lock-edge hardware only if lock reinforcement is welded to and made integral with channel.

D. Top and Bottom Channels: 0.123-inch- (3.1-mm-) thick metal channel of same material as detention door face sheets, spot welded, not more than 4 inches (102 mm) o.c., to face sheets.

1. Reinforce top edge of detention door with 0.053-inch- (1.3-mm-) thick closing channel, welded so channel web is flush with top door edges.

E. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention door face sheets with door hardware the minimum thicknesses required for specified hardware.

F. Detention Doors: Construct doors to comply with materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances indicated in NAAMM-HMMA 863 and as specified.
1. Security Grade 4: Provide doors with face sheets of 0.067-inch- (1.7-mm-) minimum-thickness, cold-rolled steel.

2.4 DETENTION FRAMES

A. General: Provide fully welded detention frames with integral stops, of seamless construction without visible joints or seams. Fabricate detention frames with contact edges closed tight and corners mitered, reinforced, and continuously welded full depth and width of detention frame.

B. Stop Height: Provide minimum stop height of 0.750 inch (19 mm) for detention door openings and minimum stop height of 1-1/4 inches (32 mm) in security glazing or detention panel openings unless otherwise indicated.

C. Interior Detention Frames: Construct interior frames to comply with materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances indicated in NAAMM-HMMA 863 and as specified.
   1. Security Grade 4: Provide frames fabricated from 0.067-inch- (1.7-mm-) minimum-thickness, cold-rolled steel.

D. Hardware Reinforcement: Fabricate reinforcing plates from same material as detention frame to comply with the minimum thicknesses required for specified hardware.

E. Jamb Anchors: Weld jamb anchors to detention frames near hinges and directly opposite on strike jamb or as required to secure detention frames to adjacent construction.

   1. Number of Anchors: Provide two anchors per jamb plus the following:
      a. Detention Frames with Security Glazing or Detention Panels: One additional anchor for each 18 inches (457 mm), or fraction thereof, above 36 inches (914 mm) in height.

   2. Masonry Anchors: Adjustable, corrugated or perforated, strap-and-stirrup anchors to suit detention frame size; formed of same material and thickness as detention frame; with strap not less than 2 inches (51 mm) wide by 10 inches (254 mm) long.

F. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of same material and thickness as detention frame, and as follows:

   1. Monolithic Concrete Slabs: Clip anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions with at least four spot welds per anchor.

G. Grout Guards: Provide factory-installed grout guards of same material as detention frame, welded to detention frame at back of hardware cutouts, silencers, and glazing-stop screw preparations to close off interior of openings and prevent mortar or other materials from obstructing hardware operation or installation.

2.5 MOLDINGS AND STOPS

A. Provide fixed moldings on inmate side of glazed openings and removable stops on non-inmate side.

   1. Height: As required to provide minimum 1-inch (25-mm) glass engagement, but not less than 1-1/4 inches (32 mm).
   2. Fixed Moldings: Formed from same material as detention door and frame face sheets, but not less than 0.093 inch (2.3 mm) thick, and spot welded to face sheets a maximum of 5 inches (127 mm) o.c.
   3. Removable Stops: Formed from 0.123-inch- (3.1-mm-) thick angle, of same material as detention door face sheets. Secure with button head security fasteners spaced uniformly not more than 6 inches (152 mm) o.c. and not more than 2 inches (51 mm) from each

corner, and as necessary to satisfy performance requirements. Form corners with notched or mitered hairline joints.

B. Coordinate rabbet width between fixed and removable stops with glass or panel type and installation type indicated.

2.6 MATERIALS

A. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, CS (Commercial Steel), Type B.

C. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

D. Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.

E. Masonry Anchors: Fabricated from same steel sheet as door face.

F. Embedded Anchors: Fabricated from mild steel shapes and plates, hot-dip galvanized in accordance with ASTM A153/A153M.

G. Glazing: Comply with aSTM F1915 Grade 4 as specified. Individual lites shall be permanently identified with a listing mark.

H. Grout: Comply with ASTM C476, with a slump of not more than 4 inches (102 mm) as measured in accordance with ASTM C143/C143M.

I. Bituminous Coating: Cold-applied asphalt mastic, 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. Waterborne Asphaltic Emulsion Coating: Minimum 2.5-mil (0.06-mm) dry film thickness.

2.7 FABRICATION

A. Fabricate detention doors and frames rigid, neat in appearance, and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate detention doors and frames to comply with manufacturing tolerances indicated in NAAMM-HMMA 863.

C. Hardware Preparation: Factory prepare detention doors and frames to receive mortised hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final Door Hardware Schedule and templates provided by detention door hardware supplier.

1. Reinforce detention doors and frames to receive surface-mounted door hardware. Drilling and tapping may be done at Project site.
2. Locate door hardware in accordance with NAAMM-HMMA 863.

D. Factory cut openings in detention doors.

E. Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM-NOMMA 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish detention doors and frames after assembly.

2.9 STEEL SHEET FINISHES

A. Surface Preparation: 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"

B. Factory Priming for Field-Painted Finish: Apply shop primer specified in "Shop Primer" Subparagraph 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 mil (0.02 mm).

1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, corrosion-inhibiting, lead- and chromate-free, universal primer complying with SDI A250.10 acceptance criteria; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

2.10 SEALANTS

A. Polyurethane Security Sealants: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement.

B. Epoxy Security Sealants: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with no movement.

2.11 ACCESSORIES

A. Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.

B. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter, headed studs welded to back of plate.

C. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

D. Pass-Through Openings: Fabricate flush openings using 0.093-inch- (2.3-mm-) thick, interior channels of same material as detention door faces, inverted to be flush with openings, welded to inside of both face sheets and with corners fully welded. Mount shutters on non-inmate side of detention doors. Reinforce for locks and food-pass hinges.

1. Inset Shutters: Fabricate from two steel plates, 0.123 inch (3.1 mm) thick, of same material as detention door face sheets, spot welded together and sized to inset inside opening and to prevent inmate tampering of lock and hinges.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of detention frame connections before detention frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Inspect embedded plate installations before installing detention frames to verify that plate installations comply with requirements. Prepare inspection reports.

1. Remove and replace plates where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Before installation and with shipping spreaders removed, adjust detention frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb and perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of face.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of door rabbet.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

3.3 INSTALLATION

A. General: Install detention doors and frames plumb, rigid, properly aligned, and securely fastened in place, complying with Drawings, schedules, and manufacturer's written instructions.

B. Anchorage: Set detention frame anchorage devices according to details on Shop Drawings and according to anchorage device manufacturer's written instructions.

1. Masonry Anchors: Coordinate frame installation to allow for solidly filling space between frames and masonry with grout.

C. Apply bituminous [**waterborne asphaltic emulsion**]coating to backs of frames before filling with grout.

D. Placing Detention Frames: Install detention frames of sizes and profiles indicated. Set detention 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.

E. Grout: Fully grout detention frame jambs and heads. Completely fill space between frames and adjacent substrates. Hand trowel grout and take other precautions, including bracing detention frames, to ensure that frames are not deformed or damaged by grout forces.

F. Security Sealant: Apply polyurethane security sealant at all exposed gaps between detention frames and adjacent substrates.

G. Swinging Detention Doors: Fit non-fire-rated detention doors accurately in their frames, with the following clearances:

1. Between Doors and Frames at Jambs and Head: 1/8 inch (3.2 mm).
2. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm).
3. At Door Sills with Threshold: 3/8 inch (9.5 mm).
4. At Door Sills without Threshold: 3/4 inch (19 mm).
5. Between Door Bottom and Nominal Surface of Floor Covering: 1/2 inch (12.7 mm).

H. Installation Tolerances: Comply with installation tolerances indicated in NAAMM-HMMA 863.

3.4 FIELD QUALITY CONTROL

A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

B. Detention work will be considered defective if it does not pass tests and inspections.

C. Perform additional inspections to determine compliance of replaced or additional work.

D. Prepare field quality-control certification that states installed products comply with requirements in the Contract Documents.

E. For verification that construction complies with requirements, select one detention door at random from detention doors delivered to Project and have it cut in half or otherwise taken apart.

1. Test Method: Verify weld strength by prying or chiseling door apart at edge seams, end channels, or stiffeners. Not more than 5 percent of welds may fail test.

a. If tested door fails, replace or rework all detention doors to bring them into compliance at Contractor's expense.
b. If tested door passes, replace tested door at Contractor's expense.

F. Prepare test and inspection reports.

3.5 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including detention doors and frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off detention doors and frames immediately after installation.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

1. After finishing smooth field welds, apply air-drying primer.

E. Stainless Steel Surfaces: Clean surfaces according to manufacturer's written instructions.

END OF SECTION 119812

SECTION 123661 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface vanities.
3. Solid surface adhesives and sealants.

B. Related Requirements:

1. Section 064116 "Plastic-Laminate-Clad Architectural Cabinets" for casework.
2. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad casework that are concealed within other construction before casework installation.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop and casework materials including manufacturer's technical data sheets, and published written instructions.

B. Sustainable Design Submittals:

1. Product Data: For adhesives and sealants, indicating VOC content.
2. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, terminations, and cutouts.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:

1. Countertop material, 6 inches (150 mm) square.

2. One full-size solid surface material countertop, with front edge, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 quality management system certification for manufacturing facility(ies).

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

1. Manufacturer-certified fabricator.

C. Installer Qualifications: Manufacturer certified fabricator of countertops.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurementsbefore countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and installer agree to repair or replace sheet material not free from defects in materials, fabrication, or workmanship within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP AND WALL MATERIALS

A. Composition Solid-Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Wilsonart LLC; 051and 025 or a comparable product by one of the following:

    a. Formica Corporation.
    b. LG Chemical, Ltd.
    c. Samsung Chemical USA, Inc
    d. Or Approved Equal.

2. Thickness: 0.490 inch (12.4 mm).
3. Panel Weight: 4.4 lb/sq. ft. (21.5 kg/sq. m).
4. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 75 or less.
    b. Smoke-Developed Index: 450 or less.
5. Colors and Patterns:

    a. 051: 9204 “Morning Ice”

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 1/2-inch (12.7-mm) thick, solid surface material with front edge built up with same material.

D. Backsplashes: 3/4-inch (19-mm) thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

F. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.

1. Joint Locations: Not within 3 inches (76 mm) of a cutout, 1 inch (25 mm) from inside corner for conventional seams, and not where countertop sections less than 36 inches (900 mm) long would result, unless unavoidable.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop.

2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Secure countertops to subtops or wood-web frame with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match

countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 210500 – COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Above ground piping.

B. Escutcheons.

C. Fire-rated enclosures.

D. Mechanical couplings.

E. Pipe hangers and supports.

F. Pipe sleeves.

G. Pipe sleeve-seal systems.

H. Retrofit: sprinkler piping cover system.

1.3 RELATED REQUIREMENTS

A. Section 078400 – Firestopping.

B. Section 210553 – Identification for Fire Suppression Piping and Equipment: Piping identification.

C. Section 211300 – Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.4 REFERENCE STANDARDS

A. ASME A112.18.1 – Plumbing Supply Fittings.

B. ASME BPVC-IX – Boiler and Pressure Vessel Code, Section IX – Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators.

C. ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

D. ASME B16.3 – Malleable Iron Threaded Fittings: Classes 150 and 300.

E. ASME B16.4 – Gray Iron Threaded Fittings: Classes 125 and 250.

F. ASTM A47/A47M – Standard Specification for Ferritic Malleable Iron Castings.

G. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

H. ASTM A536 – Standard Specification for Ductile Iron Castings.

I. ASTM A795/A795M – Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

J. ASTM C592 – Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).

K. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

L. ASTM E814 – Standard Test Method for Fire Tests of Penetration Firestop Systems.

M. AWWA C606 – Grooved and Shouldered Joints.

N. ITS (DIR) – Directory of Listed Products.

O. NFPA 13 – Standard for the Installation of Sprinkler Systems.

P. UL (DIR) – Online Certifications Directory.

Q. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.5 SCOPE OF WORK – GENERAL

A. This section specifies general requirements for Fire Suppression installations and includes requirements common to more than one section of Division 21. It expands and supplements the requirements specified in sections of Division 01.

B. Provide materials, labor, transportation, tools, permits, fees, inspections, utilities, and incidentals necessary for the complete installation of Fire Suppression work indicated and described in the Contract Documents.

C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems to complete the installation, whether mentioned or not.

1.6 SEQUENCE OF WORK

A. Conduct work in sequence to provide least possible interference to the activities of the Owner, and to permit orderly transfer of activities and equipment to completed areas.

B. Work shall be substantially complete by the dates listed in Division 01 Section “Summary”.

1.7 ALTERNATES

A. Refer to Division 01 Section “Alternates” for description of alternates. Review Contract Documents for additional information.

1.8 DEFINITIONS

A. Provide: Furnish and install complete and ready for intended use.

B. Indicated: Indicated on drawings.

C. Noted: Noted on Drawings or in Specifications.

D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in shafts.

H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.9 CODES AND STANDARDS

A. Code Compliance: Comply with most current edition adopted by the Authority Having Jurisdiction of following:

B. International Building Code (IBC), Standards and Amendments.

C. International Mechanical Code (IMC), Standards and Amendments.

D. International Fire Code (IFC), Standards and Amendments.

E. Uniform Plumbing Code (UPC), Standards and Amendments.

F. International Fuel Gas Code (IFGC).

G. National Fire Protection Association (NFPA).

H. National Electrical Code (NEC); NFPA 70.

I. Applicable State and local codes, laws, and ordinances.

1.10 SAFETY OF PERSONS AND PROPERTY

A. Comply with applicable laws, ordinances, rules, and regulations of any public authority for the safety of persons and property, including requirements of the Washington Department of Safety and Health (DOSH) or the Occupational Safety and Health Act (OSHA) whichever is most stringent, and Division 01, General and Supplementary Conditions.

1.11 PERMITS AND FEES

A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

1.12 INTENT AND INTERPRETATION

A. Drawings and Specifications supplement each other, and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

B. Drawings are partly diagrammatic and do not necessarily show exact location of new piping and existing utilities, unless specifically dimensioned.

C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of equipment. They shall not be used for obtaining quantities or lineal runs of piping.

D. Grilles, fixtures, or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.

E. Location of piping shall be checked to determine that it clears openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.

F. Mechanical drawings shall serve as working drawings for Division 21 work. Refer to Architectural, Structural and Electrical drawings for additional detail affecting the installation of work. Architectural drawings shall take precedence over the Mechanical drawings if any dimensional discrepancies exist.

G. Approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details regarding location. Exact locations are to be determined by actual measurements at the building. Not all pipe offsets are indicated on the drawings.

1.13 SUBMITTAL OF EQUIPMENT FOR APPROVAL

A. Refer to Division 01 requirements for submittal definitions, requirements, and procedures. Additional requirements are listed below.

B. Shop drawings, catalog information, and material schedules shall be submitted for approval on materials and equipment prior to ordering.

C. Submittals not meeting the following requirements will be returned for revision:
   1. Provide a cover page for each item or group of items (schedule group, single fixture plus trim group, etc.).
   2. Each cover page must be clearly identified with the project name, specification number and paragraph number.
   3. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item, and manufacturer; larger projects will be index tabbed by specification section with index for each section.

1.14 GUARANTEE

A. Guarantee satisfactory operation of material and equipment installed under Division 21. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

1.15 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Where more than one manufacturer is listed, provide products of only one manufacturer for each type of product.

B. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated “new” equipment is not acceptable.

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.

1.16 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type, or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of the bid.

B. Where more than one manufacturer is listed, and only one manufacturer’s catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).

C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 01 Section, “Substitution Procedures” for procedures in requesting

substitutions. The Owner or Owner's representative shall review all substitution requests for final approval.

D. Acceptance of substitution request signifies manufacturer recognition only. No attempt has been made to check each item as to special features, capacities, or physical dimensions required by this project. Verify requirements before submitting for approval. Acceptance of exact features, sizes, capacities, etc., all of which must meet or exceed design requirements will be determined when submitted during the construction phase.

E. Substitution request must include manufacturer, specific model number, special features, physical dimensions, and capacities of proposed equipment. Verify requirements before submitting for approval.

F. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:
   1. Costs.
   2. Available space requirements.
   3. Effect on other trades.
   4. Changes in electrical requirements.
   5. Changes in structural requirements.

1.17 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Project Record Documents: Record actual locations of components and tag numbering.

D. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.18 QUALITY ASSURANCE

A. Comply with UL (DIR) and ITS (DIR) or Warnock Hersey requirements.

B. Valves: Bear UL (DIR) and ITS (DIR) or Warnock Hersey product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

C. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

D. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.19 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Sprinkler-based System:
   1. Comply with NFPA 13.
   2. See Section 211300.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.2 ABOVE GROUND PIPING

A. Pipe or tubing shall be metallic and meet or exceed the standards of NFPA 13.

B. Steel Pipe: ASTM A795 Schedule 40, black.
   1. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
   2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
   3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, “C” shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.3 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1½-inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1½-inch angle ring or square set in silicone adhesive around penetration.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc-coated or cast-iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
   1. Brass pipe.
   2. Connect sleeve with floor plate.

2.4 PIPE SLEEVE-SEAL SYSTEMS

A. Modular Mechanical Seals:
   1. Elastomer-based interlocking links to continuously fill annular space between pipe and wall-sleeve, wall, or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall, or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Service Requirements:
   5. Underground, buried, and wet conditions.
   6. Glass-reinforced plastic pressure end plates.

B. Wall Sleeve: PVC material with water stop collar, and nailer end caps.

C. Sleeve-Forming Disk: Nonconductive plastic-based material, 3-inches thick.

D. Pipeline-Casing Seals:
   1. End Seals: ⅛-inch, pull-on type, rubber or synthetic rubber based.

2.5 FIRE-RATED ENCLOSURES

A. Provide as required to preserve fire resistance rating of building elements.

2.6 ESCUTCHEONS

A. Manufacturers:
   1. Fire Protection Products, Inc.
   2. Tyco Fire Protection Products.
   3. Viking Group Inc.

B. Material:
   1. Fabricate from nonferrous metal.
   2. Chrome-plated.
   3. Metals and Finish: Comply with ASME A112.18.1.

C. Construction:
   1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
   2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.7 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes ½- to 4-inches: Galvanized carbon steel, adjustable, band.

B. Hangers for Pipe Sizes Over 4-inches: Carbon steel, adjustable, clevis.

C. Wall Support for Pipe Sizes to 3-inches: Cast iron hook.

D. Wall Support for Pipe Sizes 4-inches and Over: Welded steel bracket and wrought steel clamp.

E. Vertical Support: Steel riser clamp.

F. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.8 MECHANICAL COUPLINGS

A. Manufacturers:
1. Anvil International.
2. Shurjoint Piping Products, Inc.
3. Tyco Fire Protection Products.
4. Victaulic Company.

B. Rigid Mechanical Couplings for Grooved Joints:
1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30°F to 230°F.
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

2.9 RETROFIT-SPRINKLER PIPING COVER SYSTEM

A. General Requirements:
1. Surface Burning Characteristics: Flame spread index/smoke developed index of 20/250, maximum, when tested in accordance with ASTM E84 or UL 723.

PART 3 - EXECUTION

3.1 COORDINATION

A. Refer to Division 01 Section “Project Management and Coordination”.

B. Coordinate available space for equipment and systems with other trades. Refer to Architectural, Structural, and Electrical Drawings for additional building details necessary for coordination.

C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between work of the various trades will be at no additional cost to the Owner.

3.2 MANUFACTURER’S INSTRUCTIONS

A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 21. If needed for proper installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer’s published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise

indicated. Promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and obtain the Architect's instructions before proceeding with the work.

3.3 EXAMINATION OF SITE

A. Visit site of proposed work and become familiar with conditions affecting work. Verify measurements at the building before beginning work.

3.4 EXISTING UTILITIES AND PIPING

A. Locations of existing concealed lines and connection points have been indicated as closely as possible from available information. Assume that such connection points are within a 10-foot (10') radius of indicated locations. Where connection points are not within this radius, contact the Architect for a decision before proceeding.

3.5 LAYING OUT WORK

A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each item of mechanical equipment, piping system, to fit available space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets or transitions in piping systems required for proper system operation and/or installation, whether indicated on drawings or not, shall be provided at no additional cost to Owner.

3.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site unless offsite storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.7 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

3.8 CUTTING AND PATCHING

A. Comply with Division 01 Section, "Execution" for general requirements for cutting and patching.

B. Cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

C. Patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, which was damaged as a result of mechanical installations. Upon receipt of written authorization from Architect, Contractor will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover work to provide for installation of ill-timed work.
   2. Remove and replace defective work.
   3. Remove and replace work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect, uncover and restore work to provide for observation of concealed work.

G. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, and other mechanical items made obsolete by new work.

H. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.9 FILLING, BACKFILLING, AND COMPACTION

A. General: Remove debris and decayable matter from areas to be filled before proceeding. Use only materials approved by the Architect for fills. Obtain Architect's approval before filling against concrete or masonry walls. Make fills as soon as feasible to insure maximum settlement.

B. Compaction of Fills: Compact by ASTM D1557, Method "A," 95% density under paved areas and building areas to 10 feet beyond building perimeter, 90% elsewhere. Place fills in lifts which, when compacted, shall not exceed 8-inches in depth and compact with multiple-wheeled pneumatic-tired rollers or other approved methods. Fills made from cuts shall be made and compacted in one operation so that the material is not left exposed to rain while in an uncompacted state.

C. Fills under Interior Slabs: 4-inches of ¾-inch to 1½ inches washed gravel, evenly graded. Cover with reinforced Kraft paper. Lap joints 4-inches, turn up 4-inches onto vertical surfaces. Repair any punctures in membrane before pouring concrete.

3.10 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

3.11 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
   1. Install hangers to provide minimum ½-inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1½-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

H. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

I. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of ½-inch where penetrations occur between conditioned and unconditioned spaces.

2. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

J. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

K. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

3.12 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 210500

SECTION 210505 – PROJECT CLOSEOUT FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK – GENERAL

A. This section specifies procedural requirements for Fire Suppression installations project closeout, including but not limited to:
   1. Project Record Document submittal.
   2. Operation and Maintenance Manual submittal.
   3. Operation and Maintenance Instruction and Training.
   4. Fire Suppression Equipment and Systems Startup.
   5. Final Cleaning.
   6. Owner Training Session Agenda.

1.3 RELATED SECTIONS INCLUDE THE FOLLOWING:

A. Division 01 Section, “Submittal Procedures”.

B. Division 01 Section “Closeout Procedures”.

1.4 PROJECT RECORD DOCUMENTS

A. Record differences between Fire Suppression work as installed and as shown in Contract Drawings on a set of prints of Fire Suppression drawings furnished by Architect. Return these prints to Architect at completion of project. Notations made on drawings shall be neat and legible. Comply with Division 01 Section requirements.

B. Mark drawings to indicate revisions to Fire Suppression piping, size and location both exterior and interior; including locations of coils, dampers, and other control devices, filters, motors, and similar items requiring periodic maintenance; actual equipment locations; concealed equipment and control devices; mains and branches of piping systems, with valves and control devices located and numbered.

C. Revise equipment and fixture schedules on the Drawings to indicate actual installed manufacturer and model numbers.

D. Mark specifications to indicate change orders; actual equipment and materials used.

1.5 OPERATION AND MAINTENANCE MANUALS

A. Prepare and submit Operation and Maintenance (O&M) Manuals for Fire Suppression systems provided. Comply with Division 01 Section requirements.

B. Provide master index at beginning of Manual showing sections and items included.

C. Cover section: List name, address, and phone number of Project Architect, General Contractor, Fire Suppression Contractor, and all Fire Suppression Subcontractors. Provide a list of equipment suppliers with address and phone number.

D. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be originals or clean copies of originals.

E. One draft copy of the manual shall be submitted for review, comment, and approval, as applicable, at least 15 days prior to substantial completion or training, whichever is first. After approval, submit three (3) copies of manual to Architect for approval unless otherwise directed by Division 01 Section requirements. Information to be included in manual:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
   2. Manufacturer's printed operating procedures to include startup, break-in, routine, and normal operating instructions; regulation, control, stopping shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.
   5. Valve schedule indicating the valve symbol (tag number), valve location by room number and description, valve purpose and system served, and valve size. Provide one (1) corresponding set of full-size Fire Suppression prints showing these valve locations for cross-reference. A second, complete set of valve schedules (8 1/2 inches x 11 inches) encased in transparent plastic laminate and fitted in an aluminum holding frame shall be furnished to the Owner.
   6. Test records and certifications.
   7. Equipment startup reports.
   8. Warranty information and letters of guarantee.
   9. Instruction period checklist for each equipment item.

F. Complete O&M Manual shall be available for use by Owner's representatives during instruction and training sessions.

1.6 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. Instruct Owner's Representative(s) in the Operation and Maintenance procedures described in Operation and Maintenance Manual. Comply with Division 01 Section requirements.

B. Enlist services of qualified personnel, including each sub-trade and factory trained specialists for each major piece of equipment, to attend training sessions and provide operation and maintenance instructions.

C. Submit training agenda, schedule, and list of representatives for review 30 days prior to training sessions. Confirm attendance by written notification to all participants.

D. Prepare checklist of all equipment and systems requiring instruction and maintenance for verification and agreement by the Owner's Representative of satisfactory startup and instruction. Checklist shall include a statement of completion by the Contractor, date and topic(s) covered in each training session, and an attendance list of all participants at each training session. Submit a copy of checklist for review 30 days prior to training sessions. Include copy of the completed checklist in Operation and Maintenance Manual.

E. Refer to individual Division 21 Sections for additional instruction/training requirements.

F. All Fire Suppression systems shall be properly functioning prior to instruction period.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 FIRE SUPPRESSION EQUIPMENT AND SYSTEMS STARTUP

A. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and demonstrate and train Owner's maintenance personnel.

B. Include certification of factory-authorized representative status as part of equipment submittal from manufacturer. Include copies of any installation and startup instructions, manufacturer's checklists, and other forms used in startup as part of the equipment submittal.

C. Include written startup reports with test data for equipment in Operation and Maintenance Manual.

D. All construction debris, including electrical wiring debris, shall be removed from units prior to equipment startup. Areas surrounding and served by equipment being started must be free of construction debris, sheetrock dust, and any materials that may adversely affect the equipment.

3.2 FINAL CLEANING

A. Refer to Division 01 general requirements for final cleaning.

B. At time of final cleanup, clean all fixtures and equipment, and leave in condition for use intended. Vacuum cabinet interiors of control panels, air handling units, etc. to remove all construction debris including electrical wiring debris.

END OF SECTION 210505

SECTION 210507 – DEMOLITION FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

1.2 SUMMARY

A. Include all labor, equipment, and materials necessary to complete demolition of existing Fire Suppression systems as shown on the drawings and described herein.

B. Mechanical Services to areas occupied by Owner shall be maintained.

C. Related Sections include the following:
   1. Division 01 Section, “Summary” for phasing requirements.
   2. Division 02 Section, “Selective Demolition” for general demolition requirements and procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

PART 2 - SALVAGE

2.1 MATERIALS OWNERSHIP

A. The Owner shall have first salvage rights to all removed fixtures and equipment. Coordinate selection with the Owner’s Representative.

B. Except for items or materials to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner’s property, demolished materials shall become Contractor’s property and removed from Project site.

C. Transport and legally dispose of offsite all materials resulting from demolition not being salvaged.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.

B. Partial Removal: Items of salvageable value to Contractor indicated to be removed, may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.

C. Protections: Ensure safe passage of people around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and people.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

F. Cut and/or patch and repair all existing floor or wall penetrations not being reused. Comply with Division 01 Section requirements.

G. Not all piping or equipment items are shown on drawings. Other demolition may be required.

H. Any existing piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.

I. Disconnect, demolish, and remove fire protection systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, etc., either to a point below floor behind wall surface, etc.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

J. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions, and replace with new products of equal capacity and quality.

END OF SECTION 210507

SECTION 210507 – DEMOLITION FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

1.2 SUMMARY

A. Include all labor, equipment, and materials necessary to complete demolition of existing Fire Suppression systems as shown on the drawings and described herein.

B. Mechanical Services to areas occupied by Owner shall be maintained.

C. Related Sections include the following:
   1. Division 01 Section, “Summary” for phasing requirements.
   2. Division 02 Section, “Selective Demolition” for general demolition requirements and procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

PART 2 - SALVAGE

2.1 MATERIALS OWNERSHIP

A. The Owner shall have first salvage rights to all removed fixtures and equipment. Coordinate selection with the Owner’s Representative.

B. Except for items or materials to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner’s property, demolished materials shall become Contractor’s property and removed from Project site.

C. Transport and legally dispose of offsite all materials resulting from demolition not being salvaged.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.

B. Partial Removal: Items of salvageable value to Contractor indicated to be removed, may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.

C. Protections: Ensure safe passage of people around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and people.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

F. Cut and/or patch and repair all existing floor or wall penetrations not being reused. Comply with Division 01 Section requirements.

G. Not all piping or equipment items are shown on drawings. Other demolition may be required.

H. Any existing piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.

I. Disconnect, demolish, and remove fire protection systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, etc., either to a point below floor behind wall surface, etc.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

J. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions, and replace with new products of equal capacity and quality.

END OF SECTION 210507

SECTION 210523 – GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Two-piece ball valves with indicators.

B. Bronze butterfly valves with indicators.

C. Iron butterfly valves with indicators.

D. Check valves.

E. Bronze OS&Y gate valves.

F. Iron OS&Y gate valves.

G. NRS gate valves.

H. Indicator posts.

I. Trim and drain valves.

1.2 RELATED REQUIREMENTS

A. Section 210553 – Identification for Fire Suppression Piping and Equipment.

1.3 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

C. NRS: Non-rising stem.

D. OS&Y: Outside screw and yoke.

E. PTFE: Polytetrafluoroethylene.

F. SBR: Styrene-butadiene rubber.

1.4 REFERENCE STANDARDS

A. NFPA 13 – Standard for the Installation of Sprinkler Systems.

B. NFPA 13R – Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies.

1.5 SUBMITTALS

A. See Section 013000 – Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturer's catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Obtain valves for each valve type from single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors and maintain at higher than ambient dew point temperature.
      b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:
   1. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with NFPA 13 and NFPA 13R for valves.

B. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

3.2 INSTALLATION

A. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.

B. Valves in horizontal piping installed with stem at or above the pipe center.

C. Position valves to allow full stem movement.

D. Install valve tags. Comply with Section 210553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION 210523

SECTION 210533 – HEAT TRACING FOR FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Self-regulating parallel resistance electric heating cable.

1.2 RELATED REQUIREMENTS

A. Section 210719 – Fire Suppression Piping Insulation.

1.3 REFERENCE STANDARDS

A. IEEE 515.1 – IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications.

B. ITS (DIR) – Directory of Listed Products; current edition.

C. NFPA 13 – Standard for the Installation of Sprinkler Systems.

D. NFPA 70 – National Electrical Code.

E. UL (DIR) – Online Certifications Directory; current edition.

1.4 SUBMITTALS

A. See Section 013000 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for electric heat tracing.

C. Shop Drawings: Indicate electric heat tracing layout, electrical terminations, thermostats, controls, and branch circuit connections.

D. Manufacturer’s Installation Instructions: Indicate installation instructions and recommendations.

E. Field Quality Control Submittals: Indicate test reports and inspection reports.

F. Project Record Documents: Record actual locations of electric heat tracing lines and thermostats.

G. Operation and Maintenance Data: Include manufacturer’s descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.

H. Warranty: Submit manufacturer’s warranty and ensure that forms have been completed in Owner’s name and registered with manufacturer.

PART 2 - PRODUCTS

2.1 CABLE OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

C. Month and year of manufacture, date coding, applicable serial number, or equivalent.

D. Agency listing or approval.

2.2 CONNECTION KITS

A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.

B. Furnish with NEMA 4X rating for prevention of corrosion and water ingress.

2.3 CONTROLS

A. Pipe Mounted Thermostats:
   1. Remote bulb unit with adjustable temperature range from 30°F to 50°F.

B. Multiple pipe segments may be controlled by a single controller using ambient control.

C. Furnish the following alarms with contacts for remote alarm for each fire sprinkler line tracing circuit:
   1. Low-Temperature Alarm: 35.6°F set point.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping and equipment are ready to receive work.

B. Verify field measurements are as indicated on shop drawings.

C. Verify required power is available, in proper location, and ready for use.

3.2 PREPARATION

A. Clean all surfaces prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer.

3.3 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Comply with installation requirements of IEEE 515.1, NFPA 70, Article 427, and applicable requirements of NFPA 13.

C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.

D. Comply with applicable local code requirements.

E. Identification:
   1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 feet including cladding over each valve or other equipment that may require maintenance.

F. Electronic Supervision:
   1. Provide positive confirmation that circuit is energized in accordance with the requirements of NFPA 13.

3.4 CLOSEOUT ACTIVITIES

A. See Section 017800 – Closeout Submittals.

B. See Section 017900 – Demonstration and Training, for additional requirements.

C. Demonstrate operation of controls.

3.5 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 210533

SECTION 210548 – VIBRATION AND SEISMIC CONTROLS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration-isolated equipment support bases.

D. Vibration isolators.

E. External seismic snubber assemblies.

F. Seismic restraint systems

1.2 RELATED REQUIREMENTS

A. Section 014533 – Code-Required Special Inspections and Procedures.

B. Section 033000 – Cast-in-Place Concrete.

1.3 DEFINITIONS

A. Fire Suppression Component: Where referenced in this section regarding seismic controls, applies to any portion of the fire suppression system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.4 REFERENCE STANDARDS

A. ASCE 19 – Structural Applications of Steel Cables for Buildings.

B. ASHRAE (HVACA) – ASHRAE Handbook – HVAC Applications.

C. FM 1950 – Seismic Sway Braces for Pipe, Tubing and Conduit.

D. MFMA-4 – Metal Framing Standards Publication.

E. NFPA 13 – Standard for the Installation of Sprinkler Systems.

F. UL 203A – Standard for Sway Brace Devices for Sprinkler System Piping.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
      b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.6 SUBMITTALS

A. See Section 0130 00 – Administrative Requirements for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
   2. Seismic Controls: Include seismic load capacities.

D. Shop Drawings – Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
   2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Shop Drawings – Seismic Controls:
   1. Include dimensioned plan views and sections indicating proposed fire suppression component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.

2. Identify mounting conditions required for equipment seismic qualification.
3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
4. Indicate proposed arrangement of distributed system trapeze support groupings.
5. Indicate proposed locations for distributed system flexible fittings and/or connections.
6. Indicate locations of seismic separations where applicable.
7. Include point load drawings indicating design loads transmitted to structure at each attachment location.

F. Seismic Design Data:
1. Compile information on project-specific characteristics of actual installed fire suppression components necessary for determining seismic design forces required to design appropriate seismic controls.
2. Include structural calculations, stamped, or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

G. Certification for seismically qualified equipment; identify basis for certification.

H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Evidence of qualifications for seismic controls designer.

K. Evidence of qualifications for manufacturer.

L. Manufacturer's detailed field testing and inspection procedures.

M. Field quality control test reports.

1.7 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years' experience designing seismic restraints for nonstructural components.
1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing fire suppression equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation: As indicated on drawings.

E. Piping Isolation:
1. Use flexible piping connections to vibration-isolated equipment.

2.2 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

B. Seismic Snubbing Elements:
1. Air Gap: Between 0.125 inch and 0.25 inch unless otherwise indicated.
2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.3 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:
1. Seismic Restraint Systems:

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Where required by NFPA 13, provide products listed as complying with UL 203A or FM 1950.

D. Cable Restraints:
1. Comply with ASCE 19.
2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
4. Use protective thimbles for cable loops where potential for cable damage exists.

E. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 014533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.3 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Vibration-Isolated Equipment Support Bases:
      a. Provide specified minimum clearance beneath base.
   2. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   3. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   4. Adjust isolators to be free of isolation short circuits during normal operation.
   5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION 210548

SECTION 210553 – IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Section 099123 – Interior Painting: Stencil paint.

1.3 REFERENCE STANDARDS

A. ASTM D709 – Standard Specification for Laminated Thermosetting Materials.

1.4 SUBMITTALS

A. See Section 013000 – Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags.

B. Control Panels: Nameplates.

C. Instrumentation: Tags.

D. Major Control Components: Nameplates.

E. Piping: Tags.

F. Pumps: Nameplates.

G. Relays: Tags.

H. Small-sized Equipment: Tags.

I. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.2 NAMEPLATES

A. Manufacturers:
1. Brimar Industries, Inc.: www.pipemarker.com.
2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com.
3. Seton Identification Products, a Tricor Direct Company: www.seton.com.

B. Description: Laminated three-layer plastic with engraved letters.
1. Letter Color: White.
2. Letter Height: ¼-inch.
3. Background Color: Black.
4. Plastic: Comply with ASTM D709.

2.3 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving, LLC:www.advancedgraphicengraving.com.
2. Brady Corporation:www.bradycorp.com.
3. Brimar Industries, .:www.pipemarker.com.
4. Craftmark Pipe Markers:www.craftmarkid.com.
5. Kolbi Pipe Marker Company:www.kolbipipemarkers.com.
6. Seton Identification Products, a Tricor Direct Company:www.seton.com.
7. Substitutions: See Section 016000 – Product Requirements.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 STENCILS

A. Manufacturers:
1. Brady Corporation:www.bradycorp.com.
2. Craftmark Pipe Markers:www.craftmarkid.com.
3. Insite Solutions, LLC:www.stop-painting.com.
4. Kolbi Pipe Marker Company:www.kolbipipemarkers.com.

5. Seton Identification Products, a Tricor Direct Company:www.seton.com.
6. Substitutions: See Section 01 60 00 – Product Requirements.

B. Stencils: With clean cut symbols and letters of following size:
1. ¾-inch to 1¼inch Outside Diameter of Insulation or Pipe: 8-inch-long color field, ½ inch high letters.
2. 1½-to 2 inch Outside Diameter of Insulation or Pipe: 8-inch-long color field, ¾-inch high letters.
3. 2½- to 6 inch Outside Diameter of Insulation or Pipe: 12-inch-long color field, 1¼- inch high letters.
4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24-inch-long color field, 2½- inch high letters.
5. Over 10 inch Outside Diameter of Insulation or Pipe: 32-inch-long color field, 3½- inch high letters.
6. Equipment: 2½- inch high letters.

C. Paint for Stencils: As specified in Section 09 91 23, semi-gloss enamel, colors complying with ASME A13.1.

2.5 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation:www.bradycorp.com.
2. Brimar Industries:www.pipemarker.com.
3. Craftmark Pipe Markers:www.craftmarkid.com.
4. Kolbi Pipe Marker Company:www.kolbipipemarkers.com.
5. Seton Identification Products, a Tricor Company:www.seton.com.
6. Substitutions: See Section 016000 – Product Requirements.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Color code as follows:
1. Fire Quenching Fluids: Red with white letters.

2.6 CEILING TACKS

A. Description: Steel with ¾-inch diameter color coded head.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 099123 for stencil painting.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 099123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Use tags on piping ¾-inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

H. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 210553

SECTION 210719 – FIRE SUPPRESSION PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.2 CODES AND STANDARDS

A. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C547 – Standard Specification for Mineral Fiber Pipe Insulation.

D. ASTM C795 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

E. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM E96/E96M – Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

G. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer’s identification, product density, and thickness.

1.4 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER

A. Manufacturers:
1. CertainTeed Corporation: www.certainteed.com.
2. Knauf Insulation; Earthwool 1000° Pipe Insulation: www.knaufinsulation.com.
3. Owens Corning Corporation: www.ocbuildingspec.com.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
1. K Value: ASTM C177, 0.24 at 75°F.
2. Maximum Service Temperature: 850°F.
3. Maximum Moisture Absorption: 0.2% by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

2.3 JACKETS

A. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.
1. Thickness: 0.010-inch.
2. Finish: Smooth.
3. Metal Jacket Bands: ⅜-inch wide; 0.010-inch-thick stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Inserts and Shields:
1. Application: Piping 1½-inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

END OF SECTION 210719

SECTION 220500 – COMMON WORK RESULTS FOR PLUMBING

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 work of this section.

1.2 SCOPE OF WORK – GENERAL

A. This section specifies general requirements for plumbing installations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in sections of Division 01.

B. Provide materials, labor, transportation, tools, permits, fees, inspections, utilities, and incidentals necessary for the complete installation of plumbing work indicated and described in the Contract Documents.

C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems to complete the installation, whether mentioned or not.

1.3 SEQUENCE OF WORK

A. Conduct work in sequence to provide least interference to the activities of the Owner, and to permit orderly transfer of activities and equipment to completed areas.

B. Work shall be substantially complete by the dates listed in Division 01 Section “Summary”.

1.4 ALTERNATES

A. Refer to Division 01 Section “Alternates” for description of alternates. Review Contract Documents for additional information.

1.5 DEFINITIONS

A. Provide: Furnish and install complete and ready for intended use.

B. Indicated: Indicated on drawings.

C. Noted: Noted on Drawings or in Specifications.

D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in shafts.

H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.6 CODES AND STANDARDS

A. Code Compliance: Comply with most current edition adopted by the Authority Having Jurisdiction of following:
1. International Building Code (IBC), Standards and Amendments.
2. International Mechanical Code (IMC), Standards and Amendments.
3. International Fire Code (IFC), Standards and Amendments.
4. Uniform Plumbing Code (UPC), Standards and Amendments.
5. International Fuel Gas Code (IFGC).
6. National Fire Protection Association (NFPA).
7. National Electrical Code (NEC); NFPA 70.
8. Washington State Energy Code, Commercial Provisions.
9. Applicable State and local codes, laws, and ordinances.

1.7 SAFETY OF PEOPLE AND PROPERTY

A. Comply with applicable laws, ordinances, rules, and regulations of any public authority for the safety of persons and property, including requirements of the Washington Department of Safety and Health (DOSH) or the Occupational Safety and Health Act (OSHA) whichever is most stringent, and Division 01, General and Supplementary Conditions.

1.8 PERMITS AND FEES

A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

1.9 INTENT AND INTERPRETATION

A. Drawings and Specifications supplement each other, and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the

specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

B. Drawings are partly diagrammatic and do not necessarily show exact location of new piping and existing utilities, unless specifically dimensioned.

C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of equipment. They shall not be used for obtaining quantities or lineal runs of piping.

D. Grilles, fixtures, or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.

E. Location of piping shall be checked to determine that it clears openings and structural members; that it may be properly concealed; and that it clears cabinets, lights, and equipment having fixed locations.

F. Mechanical drawings shall serve as working drawings for Division 22 work. Refer to Architectural, Structural and Electrical drawings for additional detail affecting the installation of work. Architectural drawings shall take precedence over the Mechanical drawings if any dimensional discrepancies exist.

G. Approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details regarding to location. Exact locations are to be determined by actual measurements at the building. Not all pipe offsets are indicated on the drawings.

1.10 SUBMITTAL OF EQUIPMENT FOR APPROVAL

A. Refer to Division 01 requirements for submittal definitions, requirements, and procedures. Additional requirements are listed below.

B. Shop drawings, catalog information, and material schedules shall be submitted for approval on materials and equipment prior to ordering.

C. Submittals not meeting the following requirements will be returned for revision:
   1. Provide a cover page for each item or group of items (schedule group, single fixture plus trim group, etc.).
   2. Each cover page must be clearly identified with the project name, specification number and paragraph number.
   3. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item, and manufacturer; larger projects will be index tabbed by specification section with index for each section.

1.11 GUARANTEE

A. Guarantee satisfactory operation of material and equipment installed under Division 22. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Where more than one manufacturer is listed, provide products of only one manufacturer for each type of product.

B. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated “new” equipment is not acceptable.

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.

2.2 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type, or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of the bid.

B. Where more than one manufacturer is listed, and only one manufacturer’s catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).

C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 1 Section “Substitution Procedures” for procedures in requesting substitutions. The Owner or Owner’s representative shall review all substitution requests for final approval.

D. Acceptance of substitution request signifies manufacturer recognition only. No attempt has been made to check each item as to special features, capacities, or physical dimensions required by this project. Verify requirements before submitting for approval. Acceptance of exact features, sizes, capacities, etc., all of which must meet or exceed design requirements will be determined when submitted during the construction phase.

E. Substitution request must include manufacturer, specific model number, special features, physical dimensions, and capacities of proposed equipment. Verify requirements before submitting for approval.

F. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:
   1. Costs.
   2. Available space requirements
   3. Effect on other trades
   4. Changes in electrical requirements
   5. Changes in structural requirements.

PART 3 - EXECUTION

3.1 COMMISSIONING

A. At a minimum, comply with requirements of the Washington State Energy Code.

B. Refer to Division 1 Section “Commissioning” for additional requirements.

3.2 COORDINATION

A. Refer to Division 1 Section “Project Management and Coordination”.

B. Coordinate available space for equipment and systems with other trades. Refer to Architectural, Structural and Electrical Drawings for additional building details necessary for coordination.

C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between work of the various trades will be at no additional cost to the Owner.

3.3 MANUFACTURER’S INSTRUCTIONS

A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 22. If needed for proper installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer’s published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. Promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer’s directions and obtain the Architect’s instructions before proceeding with the work.

3.4 EXAMINATION OF SITE

A. Visit site of proposed work and become familiar with conditions affecting work. Verify measurements at the building before beginning work.

3.5 EXISTING UTILITIES AND PIPING

A. Locations of existing concealed lines and connection points have been indicated as closely as possible from available information. Assume that such connection points are within a 10-foot radius of indicated locations. Where connection points are not within this radius, contact the Architect for a decision before proceeding.

3.6 LAYING OUT WORK

A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each item of mechanical equipment, piping system, to fit available

space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets or transitions in piping systems required for proper system operation and/or installation, whether indicated on drawings or not, shall be provided at no additional cost to Owner.

3.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.8 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

3.9 TEMPORARY USE OF NEW EQUIPMENT

A. New equipment shall not be used for temporary heating, cooling or ventilation unless authorized in writing by the Owner.

3.10 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1½-inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1½inch angle ring or square set in silicone adhesive around penetration.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc-coated or cast-iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:

1. Brass pipe.
2. Connect sleeve with floor plate.

E. Pipe Passing Through Concrete Beam Flanges, Except Where Brass Pipe Sleeves Are Specified:
1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

H. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

3.11 CUTTING AND PATCHING

A. Comply with Division 01 Section, “Execution” for general requirements for cutting and patching.

B. Cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

C. Patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, which was damaged as a result of mechanical installations. Upon receipt of written authorization from Architect, Contractor will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore work to provide for observation of concealed work.

G. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, and other mechanical items made obsolete by new work.

H. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.12 EXCAVATING AND BACKFILLING

A. Provide trench and pit excavation and backfilling required for mechanical work, inside and outside the building, including repairing of finished surfaces, required shoring, bracing, pumping, and protection for safety of persons and property. Remove excess earth resulting from their work from the site. Comply with Local or State safety codes. Check the elevations of the utilities entering and leaving the building. If such elevations require excavations lower than the footing levels, notify the Architect of such conditions before excavations are commenced. Make the excavations at the minimum required depths to not undercut the footings.

3.13 FILLING, BACKFILLING, AND COMPACTION

A. General: Remove debris and decayable matter from areas to be filled before proceeding. Use only materials approved by the Architect for fills. Obtain Architect’s approval before filling against concrete or masonry walls. Make fills as soon as feasible to insure maximum settlement.

B. Compaction of Fills: Compact by ASTM D1557, Method “A,” 95% density under paved areas and building areas to 10 feet beyond building perimeter, 90% elsewhere. Place fills in lifts which, when compacted, shall not exceed 8-inches in depth and compact with multiple-wheeled pneumatic-tired rollers or other approved methods. Fills made from cuts shall be made and compacted in one operation so that the material is not left exposed to rain while in an uncompacted state.

C. Fills under Interior Slabs: 4-inches of ¾-inch to 1½ inches washed gravel, evenly graded. Cover with reinforced Kraft paper. Lap joints 4-inches, turn up 4-inches onto vertical surfaces. Repair any punctures in membrane before pouring concrete.

END OF SECTION 220500

SECTION 220505 – PROJECT CLOSEOUT FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK – GENERAL

A. This section specifies procedural requirements for plumbing installations project closeout, including but not limited to:
   1. Project Record Document submittal.
   2. Operation and Maintenance Manual submittal.
   3. Operation and Maintenance Instruction and Training.
   4. Plumbing Equipment and Systems Startup.
   5. Final Cleaning.
   6. Owner Training Session Agenda.

B. Related Sections include the following:
   1. Section 0110 00 – Submittal Procedures.
   2. Section 017700 – Closeout Procedures.

1.3 PROJECT RECORD DOCUMENTS

A. Record differences between plumbing work as installed and as shown in Contract Drawings on a set of prints of plumbing drawings furnished by Architect. Return these prints to Architect at completion of project. Notations made on drawings shall be neat and legible. Comply with Division 01 requirements.

B. Mark drawings to indicate revisions to plumbing piping, size and location both exterior and interior; including locations of coils, dampers, and other control devices, filters, motors, and similar items requiring periodic maintenance; actual equipment locations; concealed equipment and control devices; mains and branches of piping systems, with valves and control devices located and numbered.

C. Revise equipment and fixture schedules on the Drawings to indicate actual installed manufacturer and model numbers.

D. Mark specifications to indicate change orders; actual equipment and materials used.

1.4 OPERATION AND MAINTENANCE MANUALS

Prepare and submit Operation and Maintenance (O&M) Manuals for plumbing systems provided. Comply with Section 017800 – Closeout Submittal requirements.

A. Provide primary index at beginning of Manual showing sections and items included.

B. Cover section: List name, address, and phone number of Project Architect, General Contractor, Mechanical Engineer, Plumbing Contractor, and all Plumbing Subcontractors. Provide a list of equipment suppliers with address and phone number.

C. Provide a separate section for each Section of the Specifications. Provide index for each section listing equipment included. Include all items specified.

D. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be originals or clean copies of originals.

E. One draft copy of the manual shall be submitted for review, comment, and approval, as applicable, at least 15 days prior to substantial completion or training, whichever is first. After approval, submit three (3) copies of manual to Architect for approval unless otherwise directed by Division 01 requirements. Information to be included in manual:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
   2. Manufacturer's printed operating procedures to include startup, break-in, routine, and normal operating instructions; regulation, control, stopping shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.
   5. Schematic control diagrams for each automatic control system. Mark the correct operating setting for each control instrument on these diagrams.
   6. Valve schedule indicating the valve symbol (tag number), valve location by room number and description, valve purpose and system served, and valve size. Provide one (1) corresponding set of full-size plumbing prints showing these valve locations for cross-reference. A second complete set of valve schedules (8½-inches x 11-inches) encased in transparent plastic laminate and fitted in an aluminum holding frame shall be furnished to the Owner.
   7. Testing, Adjusting and Balancing Report.
   8. Test records and certifications.
   9. Equipment startup reports.
   10. Warranty information and letters of guarantee.
   11. Instruction period checklist for each equipment item.

F. Complete O&M Manual shall be available for use by Owner's representatives during instruction and training sessions.

1.5 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. Instruct Owner's Representative(s) in the Operation and Maintenance procedures described in Operation and Maintenance Manual. Comply with Division 01 Section requirements.

B. Enlist services of qualified personnel, including each sub-trade and factory trained specialists for each major piece of equipment, to attend training sessions and provide operation and maintenance instructions.

C. Submit training agenda, schedule, and list of representatives for review 30 days prior to training sessions. Confirm attendance by written notification to all participants.

D. Prepare checklist of all equipment and systems requiring instruction and maintenance for verification and agreement by the Owner's Representative of satisfactory startup and instruction. Checklist shall include a statement of completion by the Contractor, date and topic(s) covered in each training session, and an attendance list of all participants at each training session. Submit a copy of checklist for review 30 days prior to training sessions. Include copy of the completed checklist in Operation and Maintenance Manual.

E. Refer to individual Division 22 Sections for additional instruction/training requirements.

F. All plumbing systems shall be properly functioning prior to instruction period.

PART 2 - PRODUCT (Not Applicable)

PART 3 - EXECUTION

3.1 PLUMBING EQUIPMENT AND SYSTEMS STARTUP

A. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and demonstrate and train Owner's maintenance personnel.

B. Include certification of factory-authorized representative status as part of equipment submittal from manufacturer. Include copies of any installation and startup instructions, manufacturer's checklists and other forms used in startup as part of the equipment submittal.

C. Include written startup reports with test data for equipment in Operation and Maintenance Manual.

D. All construction debris, including electrical wiring debris shall be removed from units prior to equipment startup. Areas surrounding and served by equipment being started must be free of construction debris, sheetrock dust, and any materials that may adversely affect the equipment.

3.2 FINAL CLEANING

A. Refer to Division 01 general requirements for final cleaning.

B. At time of final cleanup, clean all fixtures and equipment and leave in condition for use intended. Vacuum cabinet interiors of control panels, air handling units, etc. to remove all construction debris including electrical wiring debris.

END OF SECTION 220505

SECTION 220507 – PLUMBING DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

1.2 SUMMARY

A. Include all labor, equipment, and materials necessary to complete demolition of existing plumbing systems as shown on the drawings and described herein.

B. Mechanical Services to areas occupied by Owner shall be maintained.

1.3 RELATED SECTIONS

A. Section 011000 “Summary” for phasing requirements.

B. Section 020341 “Selective Demolition” for general demolition requirements and procedures.

1.4 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them offsite unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

PART 2 - SALVAGE

2.1 MATERIALS OWNERSHIP

A. The Owner shall have first salvage rights to all removed fixtures and equipment. Coordinate selection with the Owner’s Representative.

B. Except for items or materials to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and removed from Project site.

C. Transport and legally dispose of offsite, all materials resulting from demolition not being salvaged.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.

B. Partial Removal: Items of salvageable value to Contractor indicated to be removed, may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.

C. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

F. Cut and/or patch and repair all existing floor or wall penetrations not being reused. Comply with Division 01 Section requirements.

G. Not all piping or equipment items are shown on drawings. Other demolition may be required.

H. Any existing piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.

I. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, etc., either to a point below floor behind wall surface, etc.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

J. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions, and replace with new products of equal capacity and quality.

END OF SECTION 220507

SECTION 220553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.2 RELATED REQUIREMENTS

A. Section 099123 – Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

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

1.4 SUBMITTALS

A. Schedules:
   1. Submit plumbing component identification schedule listing equipment, piping, and valves.
   2. Detail proposed component identification data in terms of wording, symbols, letter size, and color coding to be applied to corresponding product.
   3. Valve Data Format: Include identification-number, location, function, and model number.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Pipe Markers: ¾-inch diameter and higher.

2.2 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers.

B. Pumps: Nameplates.

C. Tanks: Nameplates.

D. Valves: Tags.

2.3 NAMEPLATES

A. Manufacturers:
1. Brimar Industries, Inc.
2. Kolbi Pipe Marker Co.
3. Seton Identification Products.

B. Description: Laminated piece with up to three lines of text.
1. Letter Color: White.
2. Letter Height: ¼-inch.
3. Background Color: Black.

2.4 TAGS

A. Manufacturers:
1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Kolbi Pipe Marker Co.
5. Seton Identification Products.

B. Metal: Brass, 19-gauge 1½-inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

C. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

2.5 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Kolbi Pipe Marker Co.
5. Seton Identification Products.

B. Comply with ASME A13.1.

C. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

D. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6-inches wide by 4 mil, 0.004-inch-thick, manufactured for direct burial service.

E. Identification Scheme, ASME A13.1:
1. Primary: External Pipe Diameter, Uninsulated or Insulated.

2. Secondary: Color scheme per fluid service.
   a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.2 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping.

C. Install plastic pipe markers in accordance with manufacturer’s instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 220553

SECTION 220719 – PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Glass fiber insulation.

B. Fitting covers.

C. Protective shielding guards.

1.2 REFERENCE STANDARDS

A. ADA Standards – 2010 ADA Standards for Accessible Design.

B. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. ASTM C547 – Standard Specification for Mineral Fiber Pipe Insulation.

D. ASTM C795 – Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

E. ASTM C1822 – Standard Specification for Insulating Covers on Accessible Lavatory Piping.

F. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

G. ASTM E96/E96M – Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

H. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

I. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. See Section 220500 – Common Work Results for Plumbing for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer’s Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER INSULATION

A. Manufacturers:
   1. CertainTeed Corporation.
   2. Johns Manville Corporation.
   3. Knauf Insulation.
   4. Owens Corning Corporation.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75°F.
   2. Maximum Service Temperature: 850°F.
   3. Maximum Moisture Absorption: 0.2% by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.3 FITTING COVERS

A. Manufacturers:
   1. Johns Manville Corporation “Zeston.”
   2. P.I.C. Plastics, Inc.
   3. Proto Corporation.
   4. Speedline Corporation.

B. Jacket: One-piece molded type fitting covers, off-white color.
   1. PVC Plastic.
      a. Minimum Service Temperature: 0°F.
      b. Maximum Service Temperature: 150°F.
      c. Moisture Vapor Permeability: 0.002 perm inch, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 20 mil.
   2. Connections: Brush on welding adhesive and pressure sensitive color matching vinyl tape.

2.4 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers
   1. Manufacturers:
      a. Buckaroos, Inc.
      b. McGuire Manufacturing.
      c. MVG Molded Products.
      d. Oatey Company.
      e. Plumbrex Specialty Products
      f. Truebro, IPS Corporation.

B. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA Standards.

C. Comply with ASTM C1822 for covers on accessible lavatories.

D. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Inserts and Shields:
1. Application: Piping 1½-inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3.3 PIPING INSULATION SCHEDULE

Design Operating Temperature Range	**Insulation Conductivity**		**Nominal Pipe Diameter (Inches)**				
	Conductivity Range (Btu-Inches/ (H-Ft²-°F)	**Mean Rating Temperature (°F)**	**<1**	**1 to <1½**	**1½ to <4**	**4 to <8**	**8 to >8**
ALL DOMESTIC WATER AND SERVICE HOT WATER SYSTEMS							
105-140[1] [	0.21-0.28	100	1.0	1.0	1.5	1.5	1.5
40-60[2]	0.22-0.28	75	0.5	0.5	1.0	1.0	1.0

Notes:
[1] Hot water and hot water circulation.
[2] Cold water and rainwater piping.

END OF SECTION 220719

SECTION 220800 – COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. See Section 019113 “General Commissioning Requirements” for overall objectives; comply with the requirements of Section 019113.

B. This section covers the Contractor’s responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Pre-Functional Checklists and Functional Test Procedures for Contractor’s use.

D. The following plumbing equipment is to be commissioned, including commissioning activities for the following specific items:
1. Domestic water heaters.
2. Domestic hot water circulation systems.
3. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Pre-Functional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 RELATED REQUIREMENTS

A. Section 019113 – General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 230593 – Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 – HVAC&R Technical Requirements for the Commissioning Process.

1.4 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Startup Reports, Pre-Functional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

C. Training Manuals: See Section 017900 for additional requirements.
   1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Pre-Functional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for plumbing system testing, flushing, and cleaning, equipment startup and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when plumbing system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all plumbing and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide temperature and pressure taps in accordance with Contract Documents.

3.2 INSPECTING AND TESTING – GENERAL

A. Submit startup plans, startup reports, and Pre-Functional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Deficiencies: Correct deficiencies and reinspect or retest, as applicable, at no extra cost to Owner.

3.3 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of plumbing systems.

B. Coordinate commissioning schedule with TAB schedule.

C. Have all required Pre-Functional Checklists, calibrations, startup, and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

3.4 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.5 DEMONSTRATION AND TRAINING

A. See Section 017900 for additional requirements.

B. Demonstrate operation and maintenance of plumbing system to Owner’s personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair, or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Pre-Functional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide hands-on training of Owner’s designated personnel on operation and maintenance of the plumbing system.

E. Provide the services of manufacturer’s representatives to assist instructors where necessary.

END OF SECTION 220800

SECTION 221005 – PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary waste piping, above grade.

B. Domestic water piping, above grade.

C. Sanitary sewer: Soil, waste, and vent.

D. Pipe flanges, unions, and couplings.

E. Pipe hangers and supports.

F. Pipe sleeve-seal systems.

G. Ball valves.

H. Swing check valves.

I. Balancing valves.

J. Flow-balancing valves.

K. Strainers.

1.2 RELATED REQUIREMENTS

A. Section 220516 – Expansion Fittings and Loops for Plumbing Piping.

1.3 REFERENCE STANDARDS

A. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.

B. ASME B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. ASME B31.9 – Building Services Piping.

D. ASTM B32 – Standard Specification for Solder Metal.

E. ASTM B88 – Standard Specification for Seamless Copper Water Tube.

F. ASTM B88M – Standard Specification for Seamless Copper Water Tube (Metric).

G. ASTM B813 – Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.

H. ASTM B828 – Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

I. ASTM C564 – Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

J. ASTM C1277 – Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

K. ASTM D2235 – Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

L. ASTM F628 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core.

M. AWS A5.8M/A5.8 – Specification for Filler Metals for Brazing and Braze Welding.

N. AWWA C651 – Disinfecting Water Mains.

O. CISPI 301 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

P. CISPI 310 – Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

Q. MSS SP-58 – Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

R. MSS SP-110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

S. NSF 61 – Drinking Water System Components – Health Effects.

T. NSF 372 – Drinking Water System Components – Lead Content.

U. UL (DIR) – Online Certifications Directory.

1.4 SUBMITTALS

A. See Section 220500 – Common Work Results for Plumbing for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information. Indicate valve data and ratings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Sanitary Waste Piping Systems: Soil, waste, and vent piping.

2.2 SANITARY WASTE PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

B. ABS Pipe: ASTM F628.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

2.3 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

2.4 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.
   2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes Over 1 inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. No-Hub Couplings:
   1. Testing: In accordance with ASTM C1277 and CISPI 310.
   2. Gasket Material: Neoprene complying with ASTM C564.
   3. Band Material: Stainless steel.
   4. Eyelet Material: Stainless steel.
   5. Manufacturers:
      a. ANACO-Husky.
      b. Fernco.
      c. Ideal-Tridon Group.
      d. MIFAB, Inc.
      e. Mission Rubber Co.

2.5 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

2.6 PIPE SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. BMW Company: www.bmwcompany.com.
   2. GPT, a company of Enpro Industries, Inc.: www.gptindustries.com.
   3. The Metraflex Company.

B. Modular Mechanical Seals:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall, or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall, or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Service Requirements:
      a. Underground, buried, and wet conditions.
      b. Fire Resistant: 1 hour, UL (DIR) approved.
   5. Glass reinforced plastic pressure end plates.

2.7 BALL VALVES

A. Construction, 4 inch and Smaller Ball Valves: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome-plated brass ball, regular port, Teflon seats and stuffing box ring, blowout-proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.8 SWING CHECK VALVES

A. Manufacturers:
   1. Anvil International.
   2. Apollo Valves.
   3. Grinnell Products.
   4. NIBCO, Inc.
   5. Victaulic Company.
   6. Watts.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

2.9 BALANCING VALVES

A. Calibrated Balancing Valves, NPS 2 and Smaller:
   1. Bronze body, ball type, 125-psig working pressure, 230°F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

B. Calibrated Balancing Valves, NPS 2½- and Larger:
   1. Cast-iron or steel body, ball type, 125-psig working pressure, 230°F maximum operating temperature, and having flanged or grooved connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

C. Calibration: Control flow within 5% of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.10 FLOW-BALANCING VALVES

A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

B. Calibration: Control flow within 5% of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.11 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc.
   2. Green Country Filter Manufacturing.
   3. Jomar Valves, a division of Jomar Group.

B. Sized ½-inch to 3-inches:
   1. Class 150, threaded forged bronze Y-pattern body, stainless steel perforated mesh screen with cap, and rated for 150 psi, 250°F WOG service.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom, conserve space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 220516.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

I. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Provide copper plated hangers and supports for copper piping.

J. Pipe Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a watertight seal.
   6. Install in accordance with manufacturer's recommendations.

3.3 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
   1. Perform hydrostatic testing for leakage prior to system disinfection.
   2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
   3. General:
      a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.

C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15% of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10% of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION 221005

SECTION 223000 – PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Commercial electric water heaters.

B. Diaphragm-type compression tanks.

C. Inline circulator pumps.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P – Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ASHRAE Std 90.1 I-P – Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ASME BPVC-VIII-1 – Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels.

D. NSF 61 – Drinking Water System Components – Health Effects.

1.3 SUBMITTALS

A. See Section 22 05 00 – Common Work Results for Plumbing, for submittal procedures.

B. Product Data:
1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, capacity, power requirements.
3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

C. Warranty Documentation: Submit manufacturer’s warranty and ensure that forms have been completed in Owner’s name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Certifications:
1. Water Heaters: NSF approved.
2. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
   a. Comply with NSF 61 barrier materials for potable-water tank linings.
3. Thermal efficiency and standby loss requirements of the U. S. Department of Energy and ASHRAE Std 90.1 I-P.

4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.5 WARRANTY

A. Provide five-year manufacturer's warranty for domestic water heaters.

PART 2 - PRODUCTS

2.1 WATER HEATERS

A. Manufacturers:
   1. Rheem Manufacturing Company.
   2. A.O. Smith Water Products Co.
   3. Bock Water Heaters, Inc.

B. Commercial Electric Water Heaters:
   1. Manufacturers:
      a. Bradford White Corporation.
   2. Type: Factory-assembled and wired, electric, vertical storage.
   3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
   4. Tank: Glass lined welded steel; 4-inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
   5. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60°F to 180°F, flanged or screw-in nichrome elements, high temperature limit thermostat.
   6. Accessories:
      a. Water Connections: Brass.
      b. Dip Tube: Brass.
      c. Drain valve.
      d. Anode: Magnesium.
      e. Temperature and Pressure Relief Valve: ASME labeled.
   7. Tank: Welded steel ASME labeled pressure vessel; glass lining, mounted on steel channel base with lifting lugs, insulated with 2-inch glass fiber; enclosed with 16-gauge, 0.0598-inch steel jacket; baked enamel finish.
   8. Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cutoff, high temperature limit thermostat, flush-mounted temperature and pressure gauges.
   9. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
   1. Amtrol Inc.

2. Bell & Gossett, a xylem brand.
3. Taco, Inc.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; pre-charge to 12 psig.

2.3 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
1. Armstrong Fluid Technology.
2. Bell & Gossett, a xylem brand.
3. Taco Comfort Solutions.

B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Drive: Flexible coupling.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer’s instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Domestic Water Storage Tanks:
1. Provide steel pipe support, independent of building structural framing members.
2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

D. Pumps:
1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.

END OF SECTION 223000

SECTION 224005 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Water Closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Bilevel, electric water coolers.

F. Service sinks.

G. Emergency showers.

1.2 REFERENCE STANDARDS

A. ADA Standards – 2010 ADA Standards for Accessible Design.

B. ANSI Z358.1 – American National Standard for Emergency Eyewash and Shower Equipment.

C. ASHRAE Std 18 – Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration.

D. ASME A112.6.1M – Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.

E. ASME A112.18.1 – Plumbing Supply Fittings.

F. ASME A112.18.9 – Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures.

G. ASME A112.19.1 – Enameled Cast Iron and Enameled Steel Plumbing Fixtures.

H. ASME A112.19.2 – Ceramic Plumbing Fixtures.

I. ASME A112.19.3 – Stainless Steel Plumbing Fixtures.

J. ASME A112.19.5 – Flush Valves and Spuds for Water Closets, Urinals, and Tanks.

K. ASSE 1070 – Performance Requirements for Water Temperature Limiting Devices.

L. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

M. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

N. ICC A117.1 – Accessible and Usable Buildings and Facilities.

O. NSF 61 – Drinking Water System Components – Health Effects.

P. NSF 372 – Drinking Water System Components – Lead Content.

1.3 SUBMITTALS

A. See Section 220500 – Common Work Results for Plumbing for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings, or comparable model of the same manufacturer, or comparable product of one of the listed manufacturers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.6 WARRANTY

A. See Section 017800 – Closeout Submittals for additional warranty requirements.

B. Provide five-year manufacturer warranty for electric water cooler.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 WATER CLOSETS

A. Manufacturers:
   1. American Standard, Inc.
   2. Gerber Plumbing Fixtures LLC.
   3. Kohler Company.
   4. Zurn Industries, LLC.

B. Flush Valve Water Closets: White vitreous china, ASME A112.19.2, wall-mounted, siphon jet flush action, china bolt caps.

2.3 TOILET SEATS

A. Manufacturers:
   1. American Standard, Inc.
   2. Bemis Manufacturing Company.
   3. Church Seat Company.
   4. Olsonite.
   5. Zurn Industries, LLC.

B. Solid white plastic, open front, extended back, self-sustaining hinge, corrosion bolts, without cover.

2.4 URINALS

A. Manufacturers:
   1. American Standard, Inc.
   2. Gerber Plumbing Fixtures LLC.
   3. Kohler Company.
   4. Zurn Industries, LLC.

B. Urinals: White vitreous china, ASME A112.19.2, wall-hung with side shields and concealed carrier.

2.5 FLUSH VALVES

A. Manufacturers:
   1. American Standard, Inc.
   2. Delany Products.
   3. Sloan Valve Company.
   4. Zurn Industries, LLC.

B. Flush Valves:
   1. Type: ASME A112.19.5; chloramine-resistant, clog-resistant dual-seat diaphragm valve, complete with vacuum breaker stops and accessories.
   2. Sensor Operated: Solenoid-operated piston or electronic motor-actuated operator with battery-powered infrared sensor, and mechanical override or override pushbutton.

2.6 FIXTURE CARRIERS

A. Manufacturers:
1. Jay R. Smith MFG. Co.
2. JOSAM Company.
3. MIFAB, Inc.
4. WADE, McWane, Inc.
5. Zurn Industries, LLC.

B. Water Closet Carriers: ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

C. Urinal Carriers: ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

D. Lavatory Carriers: ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

2.7 LAVATORIES

A. Manufacturers:
1. American Standard, Inc.
2. Gerber Plumbing Fixtures LLC.
3. Kohler Company.
4. Zurn Industries, LLC.

B. Wall-Hung Basin: White vitreous china, ASME A112.19.2; wall-hung lavatory, rectangular basin with splash lip, front overflow, and soap depression.

2.8 LAVATORY FAUCETS

A. Manufacturers:
1. American Standard, Inc.
2. The Chicago Faucet Company.
3. Grohe America, Inc.
4. Kohler Company.
5. Sloan Valve Company.
6. T&S Brass and Bronze Works, Inc.
7. Zurn Industries, LLC.

B. Manual Faucet: ASME A112.18.1; chrome-plated combination supply fitting withpop-up waste, indexed handles.

C. Supply Faucet: ASME A112.18.1; chrome-plated supply fitting with single lever handle.

D. Sensor-Operated Faucet: ASME A112.18.1; chrome-plated metered mixing faucet with battery-operated solenoid operator and infrared sensor, aerator, and cover plate.

2.9 THERMOSTATIC MIXING VALVES

A. Manufacturers:
1. Acorn Engineering Company.
2. Leonard Valve Company.
3. Powers, A Watts Brand.
4. Symmons Industries, Inc.
5. Watts.
6. Zurn Industries, Inc.

B. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless-steel connectors.

2.10 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
1. Oatey.
2. Plumberex Specialty Products, Inc.
3. Truebro, IPS Corporation

B. General:
1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks per ADA Standards.
2. Construction: ⅛-inch PVC with antimicrobial-, antifungal-, and UV-resistant properties.
   a. Comply with ASTM E84 for flame and smoke development.
   b. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
   c. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.
3. Color: High-gloss white.
4. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

2.11 LAVATORY ACCESSORIES

A. Chrome-plated 17-gauge, 0.0538-inch brass P-trap with clean-out plug and arm with escutcheon.

B. Offset waste with perforated open strainer.

C. Wheel handle stops.

D. Flexible supplies.

2.12 SINKS

A. Manufacturers:
1. American Standard, Inc.
2. Elkay Manufacturing, Co.
3. Just Manufacturing, Co.

4. Kohler Company.

B. Single Compartment Bowl
1. ASME A112.19.3; 18 gauge, 0.0500-inch-thick, Type 304 stainless steel, self-rimming and undercoated, with ledge back drilled for trim.

C. Double Compartment Bowl:
1. ASME A112.19.3; 18-gauge, 0.0500-inch-thick, Type 304 stainless steel, self-rimming and undercoated, with ledge back drilled for trim.

2.13 BI-LEVEL, ELECTRIC WATER COOLERS

A. Manufacturers:
1. Elkay Manufacturing Company.
2. Haws Corporation.
3. Murdock Manufacturing, Inc.
4. Oasis International.

B. Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air-cooled condenser and stainless-steel grille.
1. Capacity: 8 gph of 50°F water with inlet at 80°F and room temperature of 90°F, when tested in accordance with ASHRAE Std 18.
2. Electrical: 115 V, 60 Hertz compressor, 6-foot cord and plug for connection to electric wiring system including grounding connector.

C. Bottle Filler: Materials to match fountain.

2.14 SERVICE SINKS

A. Manufacturers:
1. Acorn Engineering Company.
2. American Standard, Inc.
3. Gerber Plumbing Fixtures LLC.
4. Zurn Industries, LLC.

B. Bowl: ASME A112.19.1; 22-inches by 18-inches by 12-inches deep, porcelain enameled (inside only) cast iron roll-rim sink, with 12-inch-high back, concealed hanger, chrome-plated strainer, stainless steel rim guard, cast iron P-trap with adjustable floor flange.

C. Accessories:
1. 5 feet of ½-inch diameter plain end reinforced plastic hose.
2. Hose clamp hanger.

2.15 EMERGENCY SHOWERS

A. Manufacturers:

1. Haws Corporation: www.hawsco.com.
2. Therm-Omega-Tech, Inc.: www.thermomegatech.com.

B. Emergency Shower: ANSI Z358.1; wall-mounted, self- cleaning, non-clogging 8-inch diameter stainless steel deluge shower head with elbow, one-inch full flow valve with pull chain and 8-inch diameter ring, 1-inch interconnecting fittings.

C. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless-steel connectors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for specific fixtures.

3.2 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

3.3 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.4 CLEANING

A. Clean plumbing fixtures and equipment.

3.5 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 224005

SECTION 230130.51 – HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

1.2 RELATED REQUIREMENTS

A. Section 014000 – Quality Requirements: Additional requirements for testing and inspection agencies.

B. See Section 230500 – Common Work Results for HVAC for submittal procedures.

C. Section 230800 – Commissioning of HVAC.

1.3 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.

1.4 REFERENCE STANDARDS

A. NADCA ACR – The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System.

B. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors.

C. UL 181A – Closure Systems for Use with Rigid Air Ducts.

1.5 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

B. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.6 QUALITY ASSURANCE

A. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.
   1. Certified by one of the following:
      a. NADCA, National Air Duct Cleaners Association: www.nadca.com.

2. Having a minimum of three years' documented experience.

PART 2 - PRODUCTS

2.1 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97% collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" regarding a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Obtain Owner's approval of proposed temporary locations for large equipment.

E. Designate a decontamination area and obtain Owner's approval.

F. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

3.2 EXAMINATION

A. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

B. Start of cleaning work constitutes acceptance of existing conditions.

C. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

D. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.3 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
   2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
   3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.4 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner’s approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.

G. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

H. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.5 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.6 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, reclean and reinspect.

C. Coils: Cleaning must restore the coil pressure drop to within 10% of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

D. Notify Architect when cleaned components are ready for inspection.

E. When directed, reclean components until they pass.

F. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.7 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.8 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006-inch-thick polyethylene plastic bags.

B. Dispose of debris offsite in accordance with applicable federal, state, and local requirements.

END OF SECTION 230130.51

SECTION 230130.51 – HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

1.2 RELATED REQUIREMENTS

A. Section 014000 – Quality Requirements: Additional requirements for testing and inspection agencies.

B. Section 230500 – Common Work Results for HVAC for submittal procedures.

C. Section 230800 – Commissioning of HVAC.

1.3 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.

1.4 REFERENCE STANDARDS

A. NADCA ACR – The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System.

B. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors.

C. UL 181A – Closure Systems for Use with Rigid Air Ducts.

1.5 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

B. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.6 QUALITY ASSURANCE

A. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.

1. Certified by one of the following:
   a. NADCA, National Air Duct Cleaners Association: www.nadca.com.
2. Having minimum of three years' documented experience.
3. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

PART 2 - PRODUCTS

2.1 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Handheld and Wet Vacuums: Equipped with HEPA filtration with 99.97% collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant reentry to building; compliant with applicable regulations as to outdoor environmental contamination.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended," "highly recommended," or "ideally" regarding a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Obtain Owner's approval of proposed temporary locations for large equipment.

E. Designate a decontamination area and obtain Owner's approval.

F. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

3.2 EXAMINATION

A. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

B. Start of cleaning work constitutes acceptance of existing conditions.

C. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

D. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.3 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.
   1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.
   2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.
   3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.4 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner’s approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.

G. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

H. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.5 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being reopened in the future, clearly mark them, and report their locations to Owner in project report documents.

3.6 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, reclean and reinspect.

C. Coils: Cleaning must restore the coil pressure drop to within 10% of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

D. Notify Architect when cleaned components are ready for inspection.

E. When directed, reclean components until they pass.

F. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.7 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.8 WASTE MANAGEMENT

A. Double-bag waste and debris in 6 mil, 0.006-inch-thick polyethylene plastic bags.

B. Dispose of debris offsite in accordance with applicable federal, state, and local requirements.

END OF SECTION 230130.51

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK – GENERAL

A. This section specifies general requirements for HVAC installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in sections of Division 01.

B. Provide materials, labor, transportation, tools, permits, fees, inspections, utilities, and incidentals necessary for the complete installation of HVAC work indicated and described in the Contract Documents.

C. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction is required for work indicated or specified under this section of work or work specified in other sections, provide material and equipment which is usually furnished with such systems to complete the installation, whether mentioned or not.

1.3 SEQUENCE OF WORK

A. Conduct work in sequence to provide least interference to the activities of the Owner, and to permit orderly transfer of activities and equipment to completed areas.

B. Work shall be substantially complete by the dates listed in Division 01 Section “Summary”.

1.4 ALTERNATES

A. Refer to Division 01 Section “Alternates” for description of alternates. Review Contract Documents for additional information.

1.5 DEFINITIONS

A. Provide: Furnish and install complete and ready for intended use.

B. Indicated: Indicated on drawings.

C. Noted: Noted on Drawings or in Specifications.

D. Finished spaces: spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.6 CODES AND STANDARDS

A. Code Compliance: Comply with most current edition adopted by the Authority Having Jurisdiction of following:
   1. Applicable State and local codes, laws, and ordinances.
   2. International Building Code (IBC), Standards and Amendments.
   3. International Fire Code (IFC), Standards and Amendments.
   4. International Fuel Gas Code (IFGC).
   5. International Mechanical Code (IMC), Standards and Amendments.
   6. National Fire Protection Association (NFPA).
      a. NFPA 70 – National Electrical Code (NEC)
   7. Uniform Plumbing Code (UPC), Standards and Amendments.
   8. Washington State Energy Code, Commercial Provisions.

1.7 SAFETY OF PERSONS AND PROPERTY

A. Comply with applicable laws, ordinances, rules, and regulations of any public authority for the safety of persons and property, including requirements of the Washington Department of Safety and Health (DOSH) or the Occupational Safety and Health Act (OSHA) whichever is most stringent, and Division 01, General and Supplementary Conditions.

1.8 PERMITS AND FEES

A. Obtain and pay for required permits and fees necessary to fully complete work included in the Contract Documents.

1.9 INTENT AND INTERPRETATION

A. Drawings and Specifications supplement each other, and any details contained in one and not the other shall be included as if contained in both. Items not specifically mentioned in the

specifications or noted on the drawings, but which are obviously necessary to make a complete working installation shall be included.

B. Drawings are partly diagrammatic and do not necessarily show exact location of new piping and existing utilities, unless specifically dimensioned.

C. Riser and other diagrams are schematic only and do not necessarily show the physical arrangement of equipment. They shall not be used for obtaining quantities or lineal runs of piping.

D. Grilles, fixtures, or other pieces of equipment shall be centered on windows, wall spaces, or other items, unless specifically dimensioned otherwise.

E. Location of piping and ductwork shall be checked to determine that it clears openings and structural members; that it may be properly concealed; and that it clears cabinets, lights and equipment having fixed locations.

F. Mechanical drawings shall serve as working drawings for Division 23 work. Refer to Architectural, Structural, and Electrical drawings for additional detail affecting the installation of work. Architectural drawings shall take precedence over the Mechanical drawings if any dimensional discrepancies exist.

G. Approximate location of each item is indicated on the drawings. These drawings are not intended to give complete and exact details regarding location. Exact locations are to be determined by actual measurements at the building. Not all pipe and duct offsets are indicated on the drawings.

1.10 SUBMITTAL OF EQUIPMENT FOR APPROVAL

A. Refer to Division 01 requirements for submittal definitions, requirements, and procedures. Additional requirements are listed below.

B. Shop drawings, catalog information, and material schedules shall be submitted for approval on materials and equipment prior to ordering.

C. Submittals not meeting the following requirements will be returned for revision:
   1. Provide a cover page for each item or group of items (schedule group, single fixture plus trim group, etc.).
   2. Each cover page must be clearly identified with the project name, specification number, and paragraph number.
   3. Submittal package must be accompanied by an itemized index listing specification section, paragraph number, item, and manufacturer; larger projects will be index tabbed by specification section with index for each section.

1.11 GUARANTEE

A. Guarantee satisfactory operation of material and equipment installed under Division 23. Repair or replace any defective materials, equipment, or workmanship which may show itself within one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Where more than one manufacturer is listed, provide products of only one manufacturer for each type of product.

B. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Outdated "new" equipment is not acceptable.

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.

2.2 EQUIPMENT AND MATERIAL SUBSTITUTIONS

A. Throughout these Contract Documents, various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, type, or catalog number. Such designation is to establish standards of desired quality and construction, and shall be the basis of the bid.

B. Where more than one manufacturer is listed, and only one manufacturer's catalog number is indicated, that standard of quality and construction shall be maintained by materials supplied by other manufacturer(s).

C. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Division 01 Section, "Substitution Procedures" for procedures in requesting substitutions. The Owner or Owner's Representative shall review all substitution requests for final approval.

D. Acceptance of substitution request signifies manufacturer recognition only. No attempt has been made to check each item as to special features, capacities, or physical dimensions required by this project. Verify requirements before submitting for approval. Acceptance of exact features, sizes, capacities, etc., all of which must meet or exceed design requirements will be determined when submitted during the construction phase.

E. Substitution request must include manufacturer, specific model number, special features, physical dimensions, and capacities of proposed equipment. Verify requirements before submitting for approval.

F. The Contractor shall bear full responsibility for substituted equipment and materials, including, but not limited to:
   1. Costs.
   2. Available space requirements.
   3. Effect on other trades.
   4. Changes in electrical requirements.
   5. Changes in structural requirements.

PART 3 - EXECUTION

3.1 COMMISSIONING

A. At a minimum, comply with requirements of the Washington State Energy Code.

B. Refer to Division 01 Section “Commissioning” for additional requirements.

3.2 COORDINATION

A. Refer to Division 01 Section “Project Management and Coordination”.

B. Coordinate available space for equipment and systems with other trades. Refer to Architectural, Structural and Electrical Drawings for additional building details necessary for coordination.

C. Cutting, patching, wiring, finishing or any other work required for relocation of work installed due to interferences between work of the various trades will be at no additional cost to the Owner.

3.3 MANUFACTURER’S INSTRUCTIONS

A. Furnish proper equipment and/or materials required for installation as intended by the manufacturer, for all work described under Division 23. If needed for proper installation or operation, request advice and supervisory assistance from the representative of the specific manufacturer. Manufacturer’s published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated. Promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer’s directions and obtain the Architect’s instructions before proceeding with the work.

3.4 EXAMINATION OF SITE

A. Visit site of proposed work and become familiar with conditions affecting work. Verify measurements at the building before beginning work.

3.5 EXISTING UTILITIES AND PIPING

A. Locations of existing concealed lines and connection points have been indicated as closely as possible from available information. Assume that such connection points are within a 10-foot radius of indicated locations. Where connection points are not within this radius, contact the Architect for a decision before proceeding.

3.6 LAYING OUT WORK

A. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Exact locations of such items shall be determined from the Construction Drawings. Verify physical dimensions of each item of mechanical equipment, ductwork system and piping

system, to fit available space and promptly notify the Architect prior to roughing-in if conflicts appear. Coordinate equipment to available space and access routes through construction. Offsets or transitions in ductwork or piping systems required for proper system operation and/or installation, whether indicated on drawings or not, shall be provided at no additional cost to Owner.

3.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site unless offsite storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

3.8 ACCESSIBILITY

A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate location of concealed equipment and devices requiring access with location of access panels and doors. Allow ample space for removal of parts that require replacement or servicing.

3.9 TEMPORARY USE OF NEW EQUIPMENT

A. New equipment shall not be used for temporary heating, cooling or ventilation unless authorized in writing by the Owner.

3.10 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked-Out Floor Openings: Provide 1½-inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1½-inch angle ring or square set in silicone adhesive around penetration.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc-coated or cast-iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
   1. Brass pipe.
   2. Connect sleeve with floor plate.

E. Pipe Passing Through Concrete Beam Flanges, Except Where Brass Pipe Sleeves Are Specified:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

F. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

G. Not required for wall hydrants for fire department connections or in drywall construction.

H. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

I. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1-inch greater than external; pipe diameter.
   3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

3.11 CUTTING AND PATCHING

A. Comply with Division 01 Section, “Execution” for general requirements for cutting and patching.

B. Cutting shall be performed with masonry saws, core drills or similar equipment to provide neat and uniform openings.

C. Patching shall match adjacent surfaces in materials and finish. Do not endanger or damage installed work through procedures and processes of cutting and patching.

D. Arrange for repairs required to restore other work, which was damaged caused as a result of mechanical installations. Upon receipt of written authorization from Architect, Contractor will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover work to provide for installation of ill-timed work.
   2. Remove and replace defective work.
   3. Remove and replace work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect, uncover and restore work to provide for observation of concealed work.

G. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, and other mechanical items made obsolete by new work.

H. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.12 EXCAVATING AND BACKFILLING

A. Provide trench and pit excavation and backfilling required for mechanical work, inside and outside the building, including repairing of finished surfaces, required shoring, bracing, pumping, and protection for safety of persons and property. The Mechanical Contractor shall remove excess earth resulting from their work from the site. Comply with Local or State safety codes. Check the elevations of the utilities entering and leaving the building. If such elevations require excavations lower than the footing levels, notify the Architect of such conditions before excavations are commenced. Make the excavations at the minimum required depths to not undercut the footings.

3.13 FILLING, BACKFILLING, AND COMPACTION

A. General: Remove debris and decayable matter from areas to be filled before proceeding. Use only materials approved by the Architect for fills. Obtain Architect's approval before filling against concrete or masonry walls. Make fills as soon as feasible to insure maximum settlement.

B. Compaction of Fills: Compact by ASTM D1557, Method "A," 95% density under paved areas and building areas to 10 feet beyond building perimeter, 90% elsewhere. Place fills in lifts which, when compacted, shall not exceed 8-inches in depth and compact with multiple-wheeled pneumatic-tired rollers or other approved methods. Fills made from cuts shall be made and compacted in one operation so that the material is not left exposed to rain while in an uncompacted state.

C. Fills under Interior Slabs: 4-inches of ¾-inch to 1½ inches washed gravel, evenly graded. Cover with reinforced Kraft paper. Lap joints 4-inches, turn up 4-inches onto vertical surfaces. Repair any punctures in membrane before pouring concrete.

END OF SECTION 230500

SECTION 230505 – PROJECT CLOSEOUT FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK – GENERAL

A. This section specifies procedural requirements for HVAC installations project closeout, including but not limited to:
   1. Project Record Document submittal.
   2. Operation and Maintenance (O&M) Manual submittal.
   3. Operation and Maintenance Instruction and Training.
   4. HVAC Equipment and Systems Startup.
   5. Final Cleaning.
   6. Owner Training Session Agenda.

B. Related Sections include the following:
   1. Division 01 Section, “Submittal Procedures”.
   2. Division 01 Section “Closeout Procedures”.

1.3 PROJECT RECORD DOCUMENTS

A. Record differences between HVAC work as installed and as shown in Contract Drawings on a set of prints of HVAC drawings furnished by Architect. Return these prints to Architect at completion of project. Notations made on drawings shall be neat and legible. Comply with Division 01 Section requirements.

B. Mark drawings to indicate revisions to HVAC piping and ductwork, size, and location both exterior and interior; including locations of coils, dampers, and other control devices, filters, motors, and similar items requiring periodic maintenance; actual equipment locations; concealed equipment and control devices; mains and branches of piping systems, with valves and control devices located and numbered.

C. Revise equipment and fixture schedules on the Drawings to indicate actual installed manufacturer and model numbers.

D. Mark specifications to indicate change orders; actual equipment and materials used.

1.4 OPERATION AND MAINTENANCE MANUALS

A. Prepare and submit Operation and Maintenance (O&M) Manuals for HVAC systems provided. Comply with Division 01 Section requirements.

B. Provide primary index at beginning of Manual showing sections and items included.

C. Cover section: List name, address, and phone number of Project Architect, General Contractor, Mechanical Engineer, HVAC Contractor, and all HVAC Subcontractors. Provide a list of equipment suppliers with address and phone number.

D. Provide a separate section for each Section of the Specifications. Provide index for each section listing equipment included. Include all items specified.

E. Include descriptive literature (manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined. Data sheets shall be originals or clean copies of originals.

F. One (1) draft copy of the manual shall be submitted for review, comment, and approval, as applicable, at least 15 days prior to substantial completion or training, whichever is first. After approval, submit three (3) copies of manual to Architect for approval unless otherwise directed by Division 01 Section requirements. Information to be included in manual:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
   2. Manufacturer's printed operating procedures to include startup, break-in, routine, and normal operating instructions; regulation, control, stopping shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.
   5. Schematic control diagrams for each automatic control system. Mark the correct operating setting for each control instrument on these diagrams.
   6. Valve schedule indicating the valve symbol (tag number), valve location by room number and description, valve purpose and system served, and valve size. Provide one (1) corresponding set of full-size HVAC prints showing these valve locations for cross-reference. A second complete set of valve schedules (8.5 inches x 11 inches) encased in transparent plastic laminate and fitted in an aluminum holding frame shall be furnished to the Owner.
   7. Testing, Adjusting and Balancing Report.
   8. Test records and certifications.
   9. Equipment startup reports.
   10. Warranty information and letters of guarantee.
   11. Instruction period checklist for each equipment item.

G. Complete O&M Manual shall be available for use by Owner's representatives during instruction and training sessions.

1.5 OPERATION AND MAINTENANCE INSTRUCTION AND TRAINING

A. Instruct Owner's Representative(s) in the Operation and Maintenance procedures described in Operation and Maintenance Manual. Comply with Division 01 Section requirements.

B. Enlist services of qualified personnel, including each sub-trade and factory trained specialists for each major piece of equipment, to attend training sessions and provide operation and maintenance instructions.

C. Submit training agenda, schedule, and list of representatives for review 30 days prior to training sessions. Confirm attendance by written notification to all participants.

D. Prepare checklist of all equipment and systems requiring instruction and maintenance for verification and agreement by the Owner's Representative of satisfactory startup and instruction. Checklist shall include a statement of completion by the Contractor, date and topic(s) covered in each training session, and an attendance list of all participants at each training session. Submit a copy of checklist for review 30 days prior to training sessions. Include copy of the completed checklist in Operation and Maintenance Manual.

E. Refer to individual Division 23 Sections for additional instruction/training requirements.

F. All HVAC systems shall be properly functioning prior to instruction period.

PART 2 - PRODUCT (Not Applicable)

PART 3 - EXECUTION

3.1 HVAC EQUIPMENT AND SYSTEMS STARTUP

A. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and demonstrate and train Owner's maintenance personnel.

B. Include certification of factory-authorized representative status as part of equipment submittal from manufacturer. Include copies of any installation and startup instructions, manufacturer's checklists, and other forms used in startup as part of the equipment submittal.

C. Include written startup reports with test data for equipment in Operation and Maintenance Manual.

D. All construction debris, including electrical wiring debris shall be removed from units prior to equipment startup. Areas surrounding and served by equipment being started must be free of construction debris, sheetrock dust, and any materials that may adversely affect the equipment.

3.2 FINAL CLEANING

A. Refer to Division 01 general requirements for final cleaning.

B. At time of final cleanup, clean all fixtures and equipment, and leave in condition for use intended. Vacuum cabinet interiors of control panels, air handling units, etc. to remove all construction debris including electrical wiring debris.

END OF SECTION 230505

SECTION 230507 – HVAC DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to work of this section.

1.2 SUMMARY

A. Include all labor, equipment, and materials necessary to complete demolition of existing HVAC systems as shown on the drawings and described herein.

B. Mechanical Services to areas occupied by Owner shall be maintained.

C. Related Sections include the following:
   1. Division 01 Section, “Summary” for phasing requirements.
   2. Division 02 Section, “Selective Demolition” for general demolition requirements and procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

PART 2 - SALVAGE

2.1 MATERIALS OWNERSHIP

A. The Owner shall have first salvage rights to all removed fixtures and equipment. Coordinate selection with the Owner’s Representative.

B. Except for items or materials to be reused, salvaged, reinstalled, or otherwise indicated to remain owner’s property, demolished materials shall become Contractor’s property and removed from Project site.

C. Transport and legally dispose of offsite, all materials resulting from demolition not being salvaged.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Condition and Premises: The Owner assumes no responsibility for condition of areas to be demolished. General conditions existing at time of inspection for bidding purposes will be maintained by Owner.

B. Partial Removal: Items of salvageable value to Contractor indicated to be removed, may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed. Storage or sale of removed items on site will not be permitted.

C. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

E. Existing Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

F. Cut and/or patch and repair all existing floor or wall penetrations not being re-used. Comply with Division 01 Section requirements.

G. Not all piping, ductwork or equipment items are shown on drawings. Other demolition may be required.

H. Any existing ductwork or piping that is to be reused or left in existing position shall have the opening of such covered and protected during demolition and construction until final connections can be made.

I. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
   4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
   5. Equipment to Be Removed: Disconnect and cap services and remove equipment. Equipment removal shall include removal of all connecting piping, ductwork, etc., either to a point below floor behind wall surface, etc.

6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

J. If pipe, insulation, or equipment to remain is damaged in appearance during construction, or is rendered unserviceable, remove damaged or unserviceable portions, and replace with new products of equal capacity and quality.

END OF SECTION 230507

SECTION 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.2 RELATED REQUIREMENTS

A. Section 033000 – Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

A. ASHRAE (HVACA) – ASHRAE Handbook – HVAC Applications.

1.4 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

C. Shop Drawings – Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
3. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

2.2 VIBRATION ISOLATORS

A. Manufacturers:
1. Vibration Isolators:
   a. Kinetics Noise Control, Inc.: www.kineticsnoise.com.
   b. Mason Industries: www.mason-ind.com.
   c. Vibration Eliminator Company, Inc.: www.veco-nyc.come.

B. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil-, ozone-, and oxidant-resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer’s instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer’s recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
1. Spring Isolators:
   a. Position equipment at operating height; provide temporary blocking as required.
   b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.

c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.

2. Isolator Hangers:
   a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
   b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
3. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
4. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
5. Adjust isolators to be free of isolation short circuits during normal operation.
6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION 230548

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

1.2 REFERENCE STANDARDS

A. ASTM D709 – Standard Specification for Laminated Thermosetting Materials.

1.3 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

PART 2 - PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Terminal Units: Tags.

B. Ductwork: Adhesive-backed duct markers.

C. Valves: Tags.

2.2 NAMEPLATES

A. Letter Color: White.

B. Letter Height: ¼-inch.

C. Background Color: Black.

D. Plastic: Comply with ASTM D709.

2.3 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1½-inch diameter with smooth edges.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion-resistant chain.

C. Install plastic pipe markers in accordance with manufacturer’s instructions.

D. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION 230553

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

1.2 RELATED REQUIREMENTS

A. Section 230800 – Commissioning of HVAC.

1.3 REFERENCE STANDARDS

A. AABC (NSTSB) – AABC National Standards for Total System Balance, 7th Edition.

B. ASHRAE Std 111 – Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

C. NEBB (TAB) – Procedural Standards for Testing Adjusting and Balancing of Environmental Systems.

D. SMACNA (TAB) – HVAC Systems Testing, Adjusting and Balancing.

E. Washington State Energy Code Commercial Provisions, latest adopted version.

1.4 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all airflow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted, and balanced with the data cells to be gathered for each.
      c. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      e. Final test report forms to be used.

f. Procedures for formal deficiency reports, including scope, frequency, and distribution.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
5. Units of Measure: Report data in I-P (inch-pound) units only.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section independent of the installing contractors or equipment suppliers for this project.
2. Having minimum of five years documented experience of projects of similar scope and complexity.
3. Certified by one of the following:
a. AABC, Associated Air Balance Council: www.aabc.com; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

E. Pre-Qualified TAB Agencies:
1. Neudorfer Engineers.
2. AirTest Inc.
3. United Test & Balance.
4. TAC Systems.

5. Hardin and Sons.
6. Or approved equal.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   4. Duct systems are clean of debris.
   5. Fans are rotating correctly.
   6. Air coil fins are cleaned and combed.
   7. Access doors are closed and duct end caps are in place.
   8. Air outlets are installed and connected.

3.3 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within ±5% of design for supply systems and ±10% of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within +10% and −5% of design to space. Adjust outlets and inlets in space to within ±10% of design.

3.4 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50% loading of filters.

E. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

F. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

G. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

3.6 SCOPE

A. Test, adjust, and balance the following:
   1. Air Terminal Units.
   2. Air Inlets and Outlets.

3.7 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Sheave Make/Size/Bore.

B. Exhaust Fans:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Serial number.
   5. Airflow: specified and actual.
   6. Total static pressure (total external): specified and actual.
   7. Inlet pressure.
   8. Discharge pressure.
   9. Fan RPM.

C. Duct Traverses:
   1. System zone/branch.
   2. Duct size.

3. Area.
4. Design velocity.
5. Design airflow.
6. Test velocity.
7. Test airflow.
8. Duct static pressure.
9. Air temperature.

D. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design airflow.
9. Maximum design airflow.
10. Maximum actual airflow.
11. Inlet static pressure.

END OF SECTION 230593

SECTION 230713 – DUCT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

1.2 REFERENCE STANDARDS

A. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

B. ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

C. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

D. ASTM C656 – Standard Specification for Structural Insulating Board, Calcium Silicate.

E. ASTM C916 – Standard Specification for Adhesives for Duct Thermal Insulation.

F. ASTM C1071 – Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

G. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E96/E96M – Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

I. ASTM G21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

J. SMACNA (DCS) – HVAC Duct Construction Standards Metal and Flexible.

K. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
1. CertainTeed Corporation.
2. Johns Manville.
3. Knauf Insulation.
4. Owens Corning Corporation.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. K value: 0.36 at 75°F, when tested in accordance with ASTM C518.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.3 GLASS FIBER, RIGID

A. Manufacturer:
1. CertainTeed Corporation.
2. Johns Manville.
3. Knauf Insulation.
4. Owens Corning Corporation.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. K Value: 0.24 at 75°F, when tested in accordance with ASTM C518.
2. Maximum Density: 8.0 pcf.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.4 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonotlite calcium silicate, fireproofing board suitable for operating temperatures up to 1700°F. Comply with ASTM C656, Type II, Grade 6.UL tested and certified to provide a 2-hour fire rating.

B. Products:
   1. Johns Manville; Super Firetemp M.

C. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 2-hour fire rating.

D. Products:
   1. CertainTeed Corp.; FlameChek.
   2. Johns Manville; Firetemp Wrap.
   3. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
   4. Thermal Ceramics; FireMaster Duct Wrap.
   5. 3M; Fire Barrier Wrap Products.
   6. Unifrax Corporation; FyreWrap.
   7. Vesuvius; PYROSCAT FP FASTR Duct Wrap.

2.5 DUCT LINER

A. Manufacturers:
   1. CertainTeed Corporation.
   2. Johns Manville.
   3. Knauf Insulation.
   4. Owens Corning Corporation.

B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
   1. Fungal Resistance: No growth when tested according to ASTM G21.
   2. Apparent Thermal Conductivity: Maximum of 0.31 at 75°F.
   3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Complete ductwork testing prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. External Duct Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

D. Duct Liner Application:
1. Adhere insulation with adhesive for 90% coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.3 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated or scheduled, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.4 DUCT AND PLENUM INSULATION SCHEDULE:

DUCT TYPE	LOCATION/SITUATION	INSTALLED R-VALUE	OTHER REQUIREMENTS
Supply, Return[1]	Outside of Building, Climate Zone 4C	R-8	Weatherproof Jacket

DUCT TYPE	LOCATION/SITUATION	INSTALLED R-VALUE	OTHER REQUIREMENTS
Supply, Return[2]	Outside of Building, Climate Zone 5B	R-12	Weatherproof Jacket
Supply, Return[3]	Unconditioned Space[4]	R-6	
Supply	Conditioned Space[5]	R-3.3	
Supply	Conditioned Space[6]	None	
Supply, Return[7]	Conditioned Space[8]	None	
Return, Exhaust	Conditioned Space[9] Climate Zone 4c	R-8	
Return, Exhaust	Conditioned Space [10] Climate Zone 5B	R-12	
Outside Air	Between Exterior and Automatic Shutoff Damper[11]	R-16	See Energy Code for Requirements
Outside Air	Between Automatic Shutoff Damper and HVAC Unit Climate Zone 4c	R-8	
Outside Air	Between Automatic Shutoff Damper and HVAC Unit Climate Zone 5b	R-12	
Outside Air	Between Exterior and Individual Supply Units with Less Than 2800 Cfm Supply	R-7	

Notes:
[1] Including return air upstream of an energy recovery media.
[2] Including return air upstream of an energy recovery media.
[3] Including return air upstream of an energy recovery media.
[4] Not within conditioned space: In attic, in enclosed ceiling space, in walls, in garage, in crawl spaces, in concrete, underground.
[5] Conveying air greater than 55°F and less than 105°F.
[6] Ductwork exposed to view within a zone that serves that zone.
[7] Including return air upstream of an energy recovery media.
[8] Conveying air greater than 55°F and less than 105°F.
[9] Downstream of an energy recovery media, upstream of an automatic shutoff damper.
[10] Extend building envelope air and vapor control continuously from the building exterior to the automatic shutoff damper.
[11] Extend building envelope air and vapor control continuously from the building exterior to the automatic shutoff damper.

END OF SECTION 230713

SECTION 230800 – COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. See Section 019113 – General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Pre-Functional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
1. Control system.
2. Major and minor equipment items.
3. Piping systems and equipment.
4. Ductwork and accessories.
5. Terminal units.
6. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Pre-Functional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 RELATED REQUIREMENTS

A. Section 019113 – General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 230593 – Testing, Adjusting, and Balancing for HVAC.

C. Section 230913 – Instrumentation and Control Devices for HVAC.

1.3 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 – HVAC&R Technical Requirements for the Commissioning Process.

1.4 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Startup Reports, Pre-Functional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

C. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list. In addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.
      b. Room number.
      c. Room name.
      d. Air handler unit ID.
      e. Reference drawing number.
      f. Air terminal unit tag ID.
      g. Heating and/or cooling valve tag ID.
      h. Minimum airflow rate.
      i. Maximum airflow rate.
   5. Full printout of all schedules and set points after testing and acceptance of the system.
   6. Full as-built printout of software program.
   7. Electronic copy on disk of the entire program for this facility.
   8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
   9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
   10. Control equipment component submittals, parts lists, etc.
   11. Warranty requirements.
   12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
   13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
      a. Sequences of operation.
      b. Control drawings.
      c. Points lists.
      d. Controller and/or module data.
      e. Thermostats and timers.
      f. Sensors and DP switches.
      g. Valves and valve actuators.
      h. Dampers and damper actuators.
      i. Program setups (software program printouts).

D. Project Record Documents: See Section 017800 for additional requirements.
   1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
   2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and airflow stations on project record drawings.

E. Draft Training Plan: In addition to requirements specified in Section 017900, include:
   1. Follow the recommendations of ASHRAE Guideline 1.1.
   2. Control system manufacturer's recommended training.
   3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

F. Training Manuals: See Section 017900 for additional requirements.
   1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

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

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Pre-Functional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment startup and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.2 INSPECTING AND TESTING – GENERAL

A. Submit startup plans, startup reports, and Pre-Functional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Deficiencies: Correct deficiencies and reinspect or retest, as applicable, at no extra cost to Owner.

3.3 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Pre-Functional Checklists, calibrations, startup, and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.4 CONTROL SYSTEM FUNCTIONAL TESTING

A. Pre-Functional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50% more points than specified at no extra cost to Owner.
   2. Perform all trend logging specified in Pre-Functional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.
   5. That field panels read the same time as the central computer; sample 10% of field panels; if any of those fail, sample another 10%; if any of those fail, test all remaining units at no extra cost to Owner.
   6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100% of panels and 10% of ports; if any ports fail, sample another 10%; if any of those fail, test all remaining units at no extra cost to Owner.
   7. Power failure and battery backup and power-up restart functions.
   8. Global commands features.
   9. Security and access codes.
   10. Occupant overrides (manual, telephone, key, keypad, etc.).
   11. O&M schedules and alarms.
   12. Occupancy sensors and controls.
   13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.5 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.6 DEMONSTRATION AND TRAINING

A. See Section 017900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Pre-Functional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct Owner's personnel for minimum 1 hour, after completion of TAB, on the following:
   1. Review final TAB report, explaining the layout and meanings of each data type.
   2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
   3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans, and pumps that are close to or are not meeting their design capacity.
   4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
   5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 – Basic Control System: Provide minimum of 1 hour of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held onsite or at the manufacturer's facility.
      b. If held offsite, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 – Integrating with HVAC Systems: Provide minimum of 1 hour of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system startup, shutdown, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.

e. Point database entry and modifications.

3. Phase 3 – Post-Occupancy: Six months after occupancy. conduct minimum of 1 hour of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION 230800

SECTION 230900 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building Management System (BMS) utilizing direct digital controls (DDC).

B. System Description
1. Work Included:
   a. Furnish all labor, materials, and equipment necessary for a complete and operating Building Management System (BMS), utilizing direct digital controls (DDC) as shown on the drawings and as described herein. Drawings are diagrammatic only – refer to all included documentation for a complete description of work including, but not limited to, control schematics, points list, mechanical schedules, sequences of operation, and specification sections of the mechanical equipment to be controlled.
2. All workstations, building controllers, application controllers, and input/output devices furnished in this section shall communicate using the protocols and network standards as defined by ASHRAE Std 135. Gateways may be used for communication to the existing systems or to system installed under other sections.
   a. System architecture shall provide secure Web access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the Owner's LAN.
   b. The BMS server shall host all graphic files for the control system.
   c. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, and software required for the ongoing maintenance and operation of the BMS.
   d. All hardware licenses and certificates shall be stored on secure local hardware.

C. Related Work Specified Elsewhere
1. Products Not Furnished or Installed but Integrated with the Work of This Section:
   a. Variable frequency drives (VFDs).
   b. Smoke detectors (through alarm relay contacts).
2. Work Required Under Other Divisions Related to This Section:
   a. Power wiring to line side of motor starters, disconnects or variable frequency drives.
   b. Provision and wiring of smoke detectors and other devices relating to fire alarm system.
   c. Campus LAN (Ethernet) connection adjacent to Building Level Controller (BLC).

1.2 REFERENCE STANDARDS

A. ASHRAE Std 135 – BACnet™ – A Data Communication Protocol for Building Automation and Control Networks, 2020, with errata and amendments (2021).

1.3 RELATED SECTIONS

A. Section 230500 – Common Work Results for HVAC

B. Section 230505 – Project Closeout for HVAC

C. Section 230800 – Commissioning of HVAC

D. Section 23 34 16 – Centrifugal HVAC Fans

E. Section 233439 – High-Volume Low-Speed Propeller Fans

F. Section 233600 – Air Terminal Units

G. Section 237233 – Indoor Energy Recovery Ventilators

H. Section 237433 – Dedicated Outdoor Air Units

I. Section 238133 – Variable Refrigerant Flow HVAC Systems

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Submit documentation of contractor qualifications, including those indicated in "Quality Assurance" if requested by the Architect.

D. Three copies of shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers' catalog data sheets and installation instructions. Submit in printed electronic format. Samples of written Controller Checkout Sheets and Performance Verification Procedures for applications similar in scope shall be included for approval.

E. Shop drawings shall also contain complete wiring and schematic diagrams, sequences of operation, control system bus layout and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.

F. Upon completion of the work, provide two complete sets of ' as-built' drawings and other project-specific documentation in three-ring hard-backed binders and on USB media.

G. Any deviations from these specifications or the work indicated on the drawings shall be clearly identified in the Submittals.

1.5 QUALITY ASSURANCE

A. The Building Management System shall be designed, installed, commissioned, and serviced by manufacturer authorized and trained personnel. System provider shall have an in-place support facility within 2 hours' response time of the site with technical staff, spare parts inventory, and necessary test and diagnostic equipment.

B. The Control System Contractor shall have a full service DDC office within 50 miles of the job site. This office shall be staffed with applications engineers, software engineers and field technicians. This office shall maintain parts inventory and shall have all testing and diagnostic equipment necessary to support this work, as well as staff trained in the use of this equipment.

C. Single Source Responsibility of Supplier: The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation, and service of computerized building management systems similar in size and complexity to the system specified. The Control System Contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years.

D. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.6 DELIVERY, STORAGE AND HANDLING

A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.7 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between this Work and that of other crafts in equipment location; pipe, duct, and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

1.8 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Alerton as installed by ATS Automation (existing system).

B. Substitutions: Not permitted.

2.2 GENERAL

A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, a Building Level Controller (BLC), graphics and programming, and other control devices for a complete system as specified herein.

B. The installed system shall provide secure strong password access to all features, functions and data contained in the overall BMS.

2.3 BUILDING LEVEL CONTROLLER (BLC)

A. These controllers are designed to manage communications between the programmable equipment controllers (PEC) and application specific controllers (ASC) which are connected to its communications trunks, manage communications between itself and other building level controllers (BLC) and with any operator workstations (OWS) that are part of the BMS, and perform control and operating strategies for the system based on information from any controller connected to the BMS.

B. The BLC shall be compatible with multiple communications protocols, without the use of external gateway devices, including (at a minimum): BACnet (MS/TP, Ethernet, and IP), Modbus (RTU and TCP/IP), LON, SNMP, and OBIX.

C. The controllers shall be fully programmable and scalable such that the number of trunks and protocols may be selectable to meet the unique requirements of the facility it shall control.

D. The controllers shall be capable of peer-to-peer communications with other BLCs and with any OWS connected to the BMS, whether the OWS is directly connected or connected via the Internet.

E. The BLC shall be provided with a device count capacity license that supports all devices to be integrated into the BMS.

F. The BLC shall be capable of communicating with all equipment specified in these project documents. All BLCs shall be BTL listed native BACnet devices and must be capable of functioning as a BACnet Broadcast Management Device (BBMD) with a minimum of 128 entries and 3,000 subnets.

G. The BLC shall be capable of executing application control programs to provide:
   1. Calendar functions – minimum of 380 BACnet Calendar Objects.
   2. Scheduling – minimum of 380 BACnet Schedule Objects.
   3. Trending – minimum of 2,000 objects at 15-minute intervals.
   4. Alarm monitoring and routing – minimum capacity for 2,000 alarm setups.

5. Demand limiting – capable of shedding up to 1,200 loads.
6. Time synchronization.
7. Tenant activity logging – minimum of 380 zones.
8. Network management functions for all BLC-, PEC-, and ASC-based devices.

H. The BLC shall provide the following hardware features as a minimum:
1. Two 10/100 Mbps Ethernet ports.
2. Two isolated RS-485 ports.
3. 1 GB RAM.
4. Two integral Universal Inputs (configurable for thermistor, 0-10V, 4-20mA, or dry contact signals).
5. 0-122°F ambient operating temperature.
6. Option cards or expansion modules for necessary communication ports/protocols.
7. 24 VAC/DC global power supply.
8. MicroSD memory card for onboard license.

I. The BLC shall provide alarm recognition, storage, routing, and management to supplement distributed capabilities of equipment or application specific controllers.

J. The BLC shall be able to route any alarm condition to any defined user location whether connected to a local network or wide-area network.
1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
a. Alarm.
b. Return to normal.
c. To default.
2. Alarms shall be annunciated in any of the following manners as defined by the user:
a. Screen message text.
b. Email of complete alarm message to multiple recipients.
c. Graphics with flashing alarm object(s).
3. The following shall be recorded by the BLC for each alarm (at a minimum):
a. Time and date.
b. Equipment (air handler number, access way, etc.).
c. Acknowledge time, date, and user who issued acknowledgement.

2.4 PROGRAMMABLE EQUIPMENT CONTROLLER (PEC)

A. Provide one or more native BACnet application controllers for each piece of HVAC equipment or system that adequately supports all control devices required for unit/system operation and/or specified in the project documents. All controllers shall interface to BLC through either MS/TP LAN using BACnet protocol, or Ethernet LAN using BACnet over Ethernet or BACnet TCP/IP. No gateways shall be used. Controllers shall include input, output, and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation. No auxiliary or non-BACnet controllers shall be used, and all PECs shall be BTL listed.

B. All PECs shall be application programmable and shall always maintain their certification. All control sequences within or programmed into the PEC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.

C. The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.

D. All PECs shall be selected to provide sufficient Inputs/Outputs for each application. PECs shall support the following:
1. Dry contact digital inputs.
2. Pulse inputs.
3. Analog inputs with 10-bit resolution (configurable as 0-5VDC, 4-20mA, or thermistor).
4. Analog outputs (configurable as 0-10V or 0-20mA).
5. Digital/binary 24VAC triac outputs.
6. One integral 24VDC, 100mA power supply for auxiliary devices.
7. Communications for intelligent space sensor.

E. PECs may utilize expansion modules to support additional I/O requirements as needed for larger applications (e.g., central plants).

F. PECs shall support at minimum the following control techniques:
1. General-purpose control loops that can incorporate demand control and setpoint reset strategies.
2. General-purpose, non-linear control loops.
3. Start/Stop loops.
4. If/Then/Else logic loops.
5. Math function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV).

G. PECs used for central plant applications shall additionally include the following features:
1. HAND-OFF-AUTO (HOA) switches with status indicator lights for all outputs.
2. Real time clock with battery backup and time-based scheduling capabilities.
3. Onboard scheduling, logging, and alarm generation that will continue to function upon loss of communications with the BLC.

2.5 APPLICATION SPECIFIC CONTROLLER (ASC)

A. Provide one native BACnet application controllers for each piece of unitary HVAC equipment that adequately supports all control devices required for unit operation and/or specified in the project documents. All controllers shall interface to BLC through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output, and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation. No auxiliary or non-BACnet controllers shall be used, and all ASCs shall be BTL listed.

B. ASCs shall be fully programmable for the specific application with data stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained. Controllers with factory-programming that cannot be modified in the field shall not be allowed. ASCs shall always maintain their certification.

C. The ASCs shall provide LED indication of communication and controller performance to the technician, without cover removal.

D. All ASCs shall be selected to provide sufficient Inputs/Outputs for each application. ASCs shall support the following:

1. Dry contact digital inputs.
2. Analog inputs with 10-bit resolution (configurable as 0-5VDC, 4-20mA, or thermistor).
3. Analog outputs (configurable as 0-10V or 0-20mA) if required for the application.
4. Digital/binary 24VAC triac outputs.
5. Communications for intelligent space sensor.

E. ASCs shall support general-purpose control loops that can incorporate demand control and setpoint reset strategies, as well as all logic required to meet the Sequence of Operations specified in the project documents.

F. ASCs serving variable air volume (VAV) terminal units shall have onboard airflow transducers for room-level pressure-independent VAV control. Flow sensors shall be pre-calibrated at the factory with calibration data stored in non-volatile memory. Calibration data shall be field adjustable to compensate for variations in unit type and installation.

2.6 ACTUATORS

A. Electronic Actuators:
1. Actuators shall be sized based on torque required for damper seal at maximum design conditions and valve close-off pressure for system design.
2. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle; directly couple and mount to the valve bonnet stem; or ISO-style direct-coupled mounting pad.
3. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
4. Actuators shall be electronically protected from overload throughout rotation.
5. Fail-Safe Operation: Actuators serving HVAC equipment exposed to outside air shall incorporate a spring-return mechanism or electronic super capacitor for fail safe operation.
6. Power Requirements: 24VAC/DC.
7. Temperature Rating: −22°F to +122°F.
8. Control Signal: 0-10V modulating. Floating-point control shall be permissible for terminal units, zone dampers/valves, and unit heaters.
9. Manufacturer: Belimo or approved.

2.7 OTHER CONTROL SYSTEM HARDWARE

A. Intelligent Room Sensors
1. Room sensor shall include a backlit touchscreen LCD digital display, temperature sensor, humidity sensor, programmable status light indicator, and integral carbon dioxide (CO_2) sensor where indicated in the design documents.
2. Temperature sensor shall be thermistor type with an accuracy of ±0.5°F at calibration point over a range of 32°F to 140°F or better.
3. Humidity sensor shall have an accuracy of ±3% from 10% to 90% relative humidity (RH) or better, non-condensing.
4. CO_2 sensor (if applicable) shall have an accuracy of ± 30 ppm over the range of 0-5000 ppm or better. CO_2 sensor shall utilize Automatic Baseline Correction.
5. Status light shall have a minimum of four (4) colors and be fully programmable.
6. Touchscreen display shall be able to indicate:
   a. Room setpoint, room temperature, room humidity, and outside air temperature.
   b. Lighting zone status with optional ON/OFF control.

c. Window shade status with optional ON/OFF control.
d. Communication status.
e. Override status with adjustable increments.
f. Field service and balancing setpoints – password protected.

B. Duct-mounted and Outside Air Temperature Sensors: 10k-ohm thermistor temperature sensors with an accuracy of ± 0.36°F. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of 32°F to 140°F. For all mixed air and preheat air applications, install bendable averaging duct sensors.

C. Humidity sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140°F. Sensors shall be selected for wall, duct, or outdoor type installation as appropriate.

D. Carbon Dioxide (CO_2) Sensors: Sensors shall utilize non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 ppm. Sensor range shall be 0 - 2000 ppm. Accuracy shall be plus or minus five percent (5%) or 75 ppm, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC or DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high-impact plastic enclosure.

E. Current-Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

F. Differential Analog (Duct) Static Pressure Transmitters: Provide a pressure transmitter with integral capacitance type sensing and solid-state circuitry. Accuracy shall be ±1% of full range; range shall be selected for the specific application. Provide zero and span adjustment capability. Device shall have integral static pickup tube.

G. Differential Air Pressure Switches: Provide single-pole double-throw (SPDT) type, UL-approved, and selected for the appropriate operating range where applied. Switches shall have adjustable set points and barbed pressure tips.

H. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. All electrical devices within a control panel shall be factory wired. A complete set of ‘ as-built’ control drawings (relating to the controls within that panel) shall be furnished within each control panel.

I. Low Air Temperature Sensors: Provide SPST type switch with 15°F to 55° F range and manual reset.

J. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.

K. Transducers: Differential pressure transducers shall be electronic with a 4-20 mA output signal compatible to the Direct Digital Controller. Wetted parts shall be stainless steel. Unit shall be designed to operate in the pressure ranges involved.

L. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120 VAC/24 VAC operation.

M. Fire Alarm System Interface: Fire alarm system, equipment smoke detectors, and fire/smoke dampers shall be provided under Division 26. BMS shall monitor a global fire alarm status signal via auxiliary relay contact at the Fire Alarm Control Panel. Coordinate with Division 26.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 GENERAL

A. Install system and materials in accordance with manufacturer’s instructions, and as detailed on the project drawing set.

B. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.

C. Equipment furnished by the Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.

D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served.

E. All room sensors shall be mounted at a height of 48 inches above finished floor, or as specified by the architect. Providing insulating back on sensors mounted on exterior walls.

3.4 WIRING

A. All electrical control wiring to the control panels shall be the responsibility of the Control System Contractor.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. Control wiring may be installed using open plenum rated cable where allowable by code.

C. Excess wire shall not be looped or coiled in the controller cabinet.

D. Incorporate electrical noise suppression techniques in relay control circuits.

E. There shall be no drilling on the controller cabinet after the controls are mounted inside.

F. Careful stripping of wire while inside the cabinet is required to ensure that no wire strand fragments land on circuit boards.

G. Use manufacturer-specified wire for all network connections.

H. Read installation instructions carefully. Any unavoidable deviations shall be approved by Owner's rep prior to installation.

3.5 ACCEPTANCE TESTING

A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.

B. The Control System Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. System Acceptance: Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 OPERATOR TRAINING

A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the Owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software, and accessories.

B. The Control System Contractor shall provide 16 total hours of comprehensive training in multiple sessions for system orientation, product maintenance and troubleshooting, and software operation. These classes are to be spread out during the first year warranty period, with one

session to be conducted after final commissioning and an additional session to be conducted during the last month of one-year warranty period.

3.7 WARRANTY PERIOD SERVICES

A. Equipment, materials, and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner.

C. Maintenance of Computer Software Programs: The Control System Contractor shall maintain all software during the standard first year warranty period. In addition, all factory or sub-vendor revisions to software during the first year warranty period shall be added to the systems, when they become available, at no additional cost. All BLC and BMS Servers are included in this coverage.

D. Service Response: Warranty-related calls by the Owner shall be honored by end of next business day, Monday through Friday, 8 AM-5 PM Pacific Time.

E. Service Documentation: A copy of the service report associated with each Owner-initiated service call shall be provided to the Owner.

3.8 WARRANTY ACCESS

A. The Owner shall grant to the Control System Contractor reasonable access to the BMS during the warranty period including remote access to the BMS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) where allowable.

3.9 OPERATION & MAINTENANCE MANUALS

A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
   1. As-built control drawings for all equipment.
   2. As-built Network Communications Diagram.
   3. General description and specifications for all components.
   4. Completed Performance Verification sheets.
   5. Completed Controller Checkout/Calibration Sheets.

END OF SECTION 230900

SECTION 233100 – HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

C. Manufactured ductwork and fittings.

D. Flexible ducts.

1.2 REFERENCE STANDARDS

A. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM C177 – Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

C. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

D. SMACNA (DCS) – HVAC Duct Construction Standards Metal and Flexible.

E. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors.

1.3 SUBMITTALS

A. See Section 230500 “Common Work Results for HVAC” for submittal procedures.

B. Product Data: Provide data for duct materials.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor’s option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 233319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:

E. Duct Sealing and Leakage in accordance with Static Pressure Class:

F. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   3. Construct tee's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
   4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
   5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
   7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

G. Low Pressure Supply (Heating Systems): 1-inch w.g. pressure class, galvanized steel.

H. Low Pressure Supply (System with Cooling Coils): 1-inch w.g. pressure class, galvanized steel.

I. Return and Relief: 1-inch w.g. pressure class, galvanized steel.

J. General Exhaust: 1-inch w.g. pressure class, galvanized steel.

2.2 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. Construct tees, bends, and elbows with radius of not less than 1.5 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.3 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Fire Rated Ducts:
   1. Two-hour, Fire Rated Duct:
      a. UL labeled, construct of 18 gauge, 0.0516-inch galvanized steel.
      b. R-Value: 4.5 when tested in accordance with ASTM C177.

C. Rectangular Metal Duct:
   1. Rectangular Double Wall Insulated: Rectangular spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
      a. Insulation:
         1) Thickness: 1-inch.
         2) Material: Air.

D. Round Metal Ducts:
   1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
      a. Manufacturers:
         1) EHG, a DMI Company: www.ehgduct.com.
         2) Elgen Manufacturing Company, Inc; Snap Lock Pipes and Fittings: www.elgenmfg.com/#sle.
         3) Linx Industries, Inc, a DMI Company: www.li-hvac.com.
   2. Round Connection System: Interlocking duct connection system per SMACNA (DCS).

2.4 FLEXIBLE DUCTS

A. Flexible Air Ducts:
   1. UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound spring steel wire.
   2. Pressure Rating: From 10 iwc positive to 1 iwc negative.
   3. Maximum Velocity: 4,000 fpm.
   4. Temperature Range: Minus 20 to 210 degrees F.

2.5 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
   1. Pressure Rating: 10 inches w.g. positive and 1.0 inches w.g. negative.
   2. Maximum Velocity: 4000 fpm.
   3. Temperature Range: Minus 20°F to 210°F.
   4. Manufacturers:
      a. ATCO Rubber Products, Inc.
      b. Flexmaster U.S.A., Inc.
      c. Hart & Cooley, Inc.
      d. JP Lanborn, Company.
      e. Thermaflex.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

C. Duct sizes indicated are inside precise dimensions. For lined ducts, maintain sizes inside lining.

D. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

E. Fire Partitions: Provide firestopping sealing as indicated within Section 078400.

END OF SECTION 233100

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Combination fire and smoke dampers.

C. Duct access doors.

D. Fire dampers.

E. Flexible duct connectors.

F. Smoke dampers.

G. Volume control dampers.

1.2 REFERENCE STANDARDS

A. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

B. NFPA 92 – Standard for Smoke Control Systems.

C. SMACNA (DCS) – HVAC Duct Construction Standards Metal and Flexible.

D. UL 555 – Standard for Fire Dampers.

E. UL 555S – Standard for Smoke Dampers.

1.3 SUBMITTALS

A. See Section 230500 "Common Work Results for HVAC" for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

PART 2 - PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company.
   2. Nailor Industries, Inc.
   3. Ruskin Company.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Operators: UL listed and labelled spring return pneumatic type suitable for operation on 0-20 psig instrument air. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

2.3 DUCT ACCESS DOORS

A. Manufacturers:
   1. Acudor Products Inc, a Division of Nelson Industrial Inc.
   2. Ductmate Industries, Inc, a DMI Company.
   3. Elgen Manufacturing, Inc.
   4. Ward Industries, a brand of Hart and Cooley, Inc.

2.4 FIRE DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company.
   2. Nailor Industries, Inc.

B. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0-inch pressure class ducts up to 12-inches in height.

2.5 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products.
   2. Duro Dyne Corp.
   3. Elgen Manufacturing, Inc.
   4. Ventfabrics, Inc.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
      a. Net Fabric Width: Approximately 2-inches wide.
   2. Metal: 3 inches wide, 24 gauge, 0.0239-inch-thick galvanized steel.

2.6 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.

C. Electro Thermal Link: Fusible link melting at 165°F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.7 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8-inches by 72-inches. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

C. End Bearings: Except in round ducts 12-inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

D. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 233100 for duct construction and pressure class.

B. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings, and hinges.

C. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

D. Demonstrate resetting of fire dampers to Owner's representative.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct takeoff.

H. Provide balancing dampers at each branch duct shaft penetration.

I. Provide balancing dampers on duct takeoff to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly. Locate dampers as far upstream as possible and in accessible locations.

J. Provide concealed type regulators, utilizing miter gears and universal joints as required, for dampers located above hard ceilings or in non-accessible locations.

END OF SECTION 233300

SECTION 233416 – CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Backward inclined centrifugal fans.

B. Bearings and drives.

1.2 RELATED REQUIREMENTS

A. Section 230513 – Common Motor Requirements for HVAC Equipment.

B. Section 230548 – Vibration and Seismic Controls for HVAC.

C. Section 233300 – Air Duct Accessories: Backdraft dampers.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 – Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA (DIR) – (Directory of) Products Licensed Under AMCA International Certified Ratings Program.

C. AMCA 99 – Standards Handbook.

D. AMCA 210 – Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

E. AMCA 300 – Reverberant Room Method for Sound Testing of Fans.

F. AMCA 301 – Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

1.4 SUBMITTALS

A. See Section 230500 “Common Work Results for HVAC” for submittal procedures.

B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Include complete installation instructions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Loren Cook Company

B. Twin City Fan & Blower

C. Greenheck

2.2 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

2.3 WHEEL AND INLET

A. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate; cast iron or cast steel hub riveted to back plate and keyed to shaft with set screws.

2.4 HOUSING

A. Heavy gauge steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut.

B. Factory finish before assembly to manufacturer's standard. For fans handling air downstream of humidifiers, provide two additional coats of paint.

2.5 BEARINGS AND DRIVES

A. Bearings: Heavy-duty pillow block type, self-greasing ball bearings, with ABMA STD 9 life at 50,000 hours.

B. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.

C. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid. Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible connections between fan inlet and discharge ductwork; see Section 233300. Ensure metal bands of connectors are parallel with minimum one-inch flex between ductwork and fan while running.

C. Install fan restraining snubbers; see Section 230548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

END OF SECTION 233416

SECTION 233439 – HIGH-VOLUME, LOW-SPEED PROPELLER FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. High-volume, low-speed propeller fans.

1.2 REFERENCE STANDARDS

A. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

B. UL 507 – Electric Fans.

1.3 SUBMITTALS

A. See Section 230500 “Common Work Results for HVAC” for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 507.

B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.2 HIGH-VOLUME, LOW-SPEED PROPELLER FANS

A. Manufacturers:
   1. Greenheck.
   2. Big Ass Fans.

B. Mounting Options: I-beam.

C. Direct Drive Fan:
   1. Statically and dynamically balanced.
   2. Motors:
      a. Open drip-proof (ODP).

b. Heavy-duty ball bearing type.
c. Mount on vibration isolators or resilient cradle mounts, out-of-airstream.
d. Fully accessible for maintenance.

D. Shafts and Bearings:
1. Fan Shaft:
a. Ground and polished steel with anti-corrosive coating.
b. First critical speed at least 25% over maximum cataloged operating speed.
2. Bearings:
a. Permanently sealed or pillow block type.
b. Minimum L_{10} life in excess of 100,000 hours (equivalent to L_{50} average life of 500,000 hours), at maximum cataloged operating speed.
c. 100% factory tested.

E. Disconnect Switches:
1. Factory mounted and wired.
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
3. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory-applied gray unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

F. Accessories:
1. External motor speed controllers for field mounting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure fan with stainless steel lag screws to structure.

END OF SECTION 233439

SECTION 233600 – AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fan-powered units.

1.2 REFERENCE STANDARDS

A. AHRI 880 (I-P) – Performance Rating of Air Terminals.

B. ASTM A492 – Standard Specification for Stainless Steel Rope Wire.

C. ASTM A603 – Standard Specification for Metallic-Coated Steel Structural Wire Rope.

D. ASTM C1071 – Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

E. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NFPA 70 – National Electrical Code.

G. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

H. SMACNA (SRM) – Seismic Restraint Manual Guidelines for Mechanical Systems.

1.3 SUBMITTALS

A. See Section 230500 “Common Work Results for HVAC” for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

D. Manufacturer’s Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

F. Operation and Maintenance Data: Include manufacturer’s descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 WARRANTY

A. See Section 017800 – Closeout Submittals, for additional warranty requirements.

B. Provide five-year manufacturer's warranty for air terminal units.

PART 2 - PRODUCTS

2.1 FAN-POWERED SERIES UNITS

A. Manufacturers:
1. Nailor.
2. Price Industries, Inc.
3. Trane, a brand of Ingersoll Rand.

B. General:
1. Factory-assembled and wired, AHRI 880 (I-P) rated, horizontal fan-powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.

C. Unit Casing:
1. Minimum 22 gauge, 0.0299-inch galvanized steel.
2. Primary Air Inlet Collar: Suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, suitable for flanged duct connection.
4. Acceptable Liners:
   a. ½-inch thick, coated, fibrous-glass complying with ASTM C1071.
      1) Secure with adhesive.
      2) Coat edges exposed to airstream with NFPA 90A approved sealant.
      3) Cover liner with non-porous foil.

D. Primary Air Damper Assembly:
1. Heavy-gauge, galvanized steel or extruded aluminum construction with solid shaft rotating in bearings.
2. Provide indicator on damper shaft or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak (2%) damper blades for tight airflow shutoff.
4. Fan(s): Forward curved, centrifugal type.
5. Fan Motor:
   a. ECM (Electrically Commutated Motor):
   b. Fan motor shaft directly connected to fan and isolated from unit casing to prevent transmission of vibration.

E. Electric Heating Coil:
1. Listed and provided by the terminal unit manufacturer.
2. Coil Casing: Minimum 20-gauge, 0.0359-inch galvanized steel.

3. Heating Elements: Open wire, nickel chrome, supported by ceramic insulators.
4. Integral Control Panel: NEMA 250, Type 2 enclosure, with hinged access door for access to all controls and safety devices.
5. Provide a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow or electrical interlock to prevent heater operation when fan is not running.
6. Provide the following additional components, mounted and/or wired within the control enclosure:
   a. Fused or non-fused door interlocking disconnect switch.
   b. Mercury contactors.
   c. Fuse block.
7. Provide SCR (Silicon Controlled Rectifier) controller.

F. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

G. Controls:
1. Electric:
   a. Wall-mounted electric thermostat including 24-volt damper actuator and mounting hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. Provide ceiling access doors or locate units above easily removable ceiling components.

D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 230548.

E. Do not support from ductwork.

F. Connect to ductwork in accordance with Section 233100.

END OF SECTION 233600

SECTION 233700 – AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Diffusers:
   1. Rectangular ceiling diffusers.

B. Registers/Grilles:
   1. Ceiling-mounted, egg crate exhaust and return register/grilles.
   2. Sidewall mounted, suicide-/tamper-proof.

1.2 REFERENCE STANDARDS

A. AAMA 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. AMCA 500-L – Laboratory Methods of Testing Louvers for Rating.

C. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM B221M – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

1.3 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc.

B. Hart & Cooley, Inc.

C. Krueger-HVAC.

D. Price Industries.

E. Titus, a brand of Air Distribution Technologies.

F. Tuttle and Bailey.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, adjustable pattern, stamped, multi-core diffuser to discharge air in an adjustable pattern.

B. Connections: Rectangular.

C. Frame: 1¼-inch margin with countersunk screw mounting for surface mounting.

D. Frame: Channel lay-in frame for suspended grid ceilings.

E. Fabrication: Steel with baked enamel finish.

F. Color: white.

2.3 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of ½-inch by ½-inch by ½-inch grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: To be selected by Architect from manufacturer’s standard range.

D. Frame: 1¼-inch margin with countersunk screw mounting for surface mounting.

E. Frame: Channel lay-in frame for suspended grid ceilings.

2.4 EXTRUDED ALUMINUM LOUVERS

A. Stationary Louvers: Horizontal blade, extruded aluminum construction, with intermediate mullions matching frame.
   1. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper.
   2. Free Area: 50%, minimum.
   3. Pressure Drop: 0.20 inches of water gauge maximum per square foot of free area at velocity of 1000 fpm, when tested in accordance with AMCA 500-L, test unit size 48-inches by 48-inches.
   4. Blades: Straight.
   5. Frame: 4 inches deep, channel profile; mitered corner joints.
   6. Aluminum Thickness: Frame 12-gauge, 0.0808 inch minimum; blades 12-gauge, 0.0808-inch minimum.
   7. Aluminum Finish: Pigmented organic coatings; finish welded units after fabrication.

B. Finishes:
   1. Pigmented Organic Coatings: AAMA 2603; polyester or acrylic baked enamel finish.
   2. Primer: Zinc chromate, alkyd type.

3. Color: As indicated on drawings.

C. Accessories:
1. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
2. Bird Screen: Interwoven wire mesh of steel, 14-gauge, 0.0641-inch diameter wire, ½-inch open weave, diagonal design.
3. Fasteners and Anchors: Stainless steel.
4. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Provide balancing dampers on duct takeoff to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

D. Coordinate with installation of flashings by others.

E. Set sill members and sill flashing in continuous bead of sealant.

F. Coordinate with installation of mechanical ductwork.

END OF SECTION 233700

SECTION 233813 – COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall-mounted residential hoods.

1.2 REFERENCE STANDARDS

A. ASTM A666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. NFPA 96 – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

C. SMACNA (KVS) – Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines.

D. UL 507 – Electric Fans.

E. UL 710 – Standard for Exhaust Hoods for Commercial Cooking Equipment.

1.3 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions, adjusting, and balancing methods.

C. Shop Drawings: For each custom fabricated unit, provide drawings showing details of construction, dimensions, and interfaces with adjacent construction.

PART 2 - PRODUCTS

2.1 HOOD CONSTRUCTION

A. Provide products that comply with NFPA 96, the requirements and recommendations of SMACNA (KVS), and the requirements of the Authorities Having Jurisdiction.

B. Construction: Materials, inside and out, are stainless steel complying with ASTM A666, Type 304, stretcher leveled; unless otherwise indicated.
   1. Provide complete assemblies listed and labeled by UL under UL 710 for its intended use.
   2. Sheet Thickness: 18-gauge, 0.048-inch, minimum.

3. Fabrication: Fabricate each individual hood in one piece, with all welds ground and finished to match (inside and out); fabricate flat surfaces exposed to view as double-pan formed panels with internal stiffener members.
4. Finish on Surfaces Exposed to View: No. 4 (brushed directional); provide stainless steel faces on all sides exposed to view.
5. Finish on Concealed Surfaces: No. 4 or No. 2B (dull, matte).
6. Duct Collars: For exhaust and make-up air openings, provide duct collar welded to hood unit; minimum of 8-inches extension from top or back face of unit, with minimum 1-inch 90-degree flange, unless otherwise indicated.
7. Access Panels: Provide removable or hinged access panels sufficient for maintenance and replacement of operating components inside unit; maximum width of 40-inches.
8. Supports: Stainless steel mounting brackets, struts, and threaded hanger rods.
    a. Hanger Rods: ⅜-inch diameter, minimum.
    b. Hanger Spacing: 48-inches on center, maximum.
    c. Attachment to Structure: Mechanical fittings or inserts, stainless steel.

2.2 HOOD ACCESSORIES

A. Controls:
1. Fans: Provide manual push button controls for starting and stopping fans and labeled indicator lights showing fan status.

B. Control Panels: Factory assembled and pre-wired, ready for utility connections.
1. UL listed for use with specific hood.
2. Provide a single control panel combining all control functions for a particular hood, unless otherwise indicated.
3. Provide a single control panel for each group of hoods served by a single exhaust fan.
4. Enclosures: Flush-mounted; stainless steel, to match hood.
5. Provide indicator lights on control panel door showing status of fans and power supply.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products per manufacturer’s instructions.

END OF SECTION 233813

SECTION 237226 – INDOOR ENERGY RECOVERY VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Energy recovery ventilators.

1.2 REFERENCE STANDARDS

A. AHRI 1060 (I-P) – Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

B. ASHRAE Std 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

C. ASHRAE Std 84 – Method of Testing Air-to-Air Heat/Energy Exchangers.

D. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

E. NFPA 70 – National Electrical Code.

F. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

G. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. See Section 23 05 00 “Common Work Results for HVAC” for submittal procedures.

B. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.

C. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84or UL 723.

2.2 MANUFACTURERS

A. Energy Recovery Ventilators:
   1. Fantech, Systemair AB.
   2. Greenheck Fan Corporation.
   3. Oxygen8.
   4. Panasonic Corporation of North America.
   5. RenewAire.
   6. Ruskin Company.
   7. Soler Palau – USA.

2.3 INDOOR ENERGY RECOVERY VENTILATORS

A. Energy Recovery Ventilators: Provide desiccant wheel type or stationary core air-to-air exchanger; prefabricated packaged system designed by manufacturer.
   1. Provide unit with an AHRI 1060 (I-P) compliant air-to-air exchanger.

2.4 CASING

A. Construction: Single wall, minimum 22-gauge galvanized steel sheet. Galvanized steel framing.

B. Coating: Baked powder paint.

C. Access: Hinged and/or screwed access panels.

D. Insulation:1-inch insulated fiberglass with FSK facing.
   1. Secure insulation to unit with waterproof adhesive and permanent mechanical fasteners.

2.5 FANS

A. Provide separate fans for exhaust and supply blowers.

B. Fans:
   1. Common driven with one motor.

C. Housings: 12-gauge, 0.1046-inch aluminized steel with plenums integral to general housing and constructed to Class 1 fan standards.

D. Motors:
   1. Motors: Electronically commutated (EC).
   2. Efficiency: High.
   3. Speed: Single.
   4. Control: Constant Speed.
   5. Fan Motor: UL listed and labeled.

2.6 STATIONARY ENERGY RECOVERY CORE

A. Stationary Core: AHRI 1060 (I-P)certified, air-to-air energy exchanger with evenly spaced and sealed plates arranged for counter airflow.

B. Plate Material: Washable, polymer fiber membrane with selective hydroscopic and moisture permeability, and gas barrier properties.

2.7 ENERGY RECOVERY WHEEL

A. Wheel: Transfer heat and humidity from one air stream to the other with minimum carryover of the exhaust air into the supply air stream.

B. Wheel Effectiveness: Rated in accordance with ASHRAE Std 84 and AHRI 1060 (I-P).

C. Energy Recovery Wheel Media Face:
   1. Comply with NFPA 90A.

D. Rotor:
   1. Type: Non-segmented hygroscopic aluminum wheel.
   2. Rotor Matrix: Corrosion resistant aluminum alloy composed of alternating corrugated and flat, continuously wound layers of uniform widths.

E. Desiccant:
   1. Type: 3A.

F. Drive:
   1. Drive: Tensioned drive with full perimeter link style belt.

2.8 FILTERS

A. Exhaust and Fresh Air Streams: MERV 8 filters constructed to meet ASHRAE Std 52.2.

2.9 POWER AND CONTROLS

A. Provide single-point field connection to power supply.

B. Provide non-fused main disconnect integral to control panel.

C. Install wiring in accordance with NFPA 70.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

3.2 INSTALLATION

A. Provide openings for suitable ductwork connection.

3.3 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION 237226

SECTION 237233 – ENERGY RECOVERY AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Casing construction.

B. Fans, supply, and exhaust.

C. Fixed plate sensible heat exchanger.

D. Water heating coils.

E. Air Filters.

F. Dampers.

G. Controls.

1.2 REFERENCE STANDARDS

A. AHRI 1060 (I-P) – Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

B. AHRI 1350 – Mechanical Performance Rating of Central Station Air-Handling Units.

C. AMCA (DIR) – (Directory of) Products Licensed Under AMCA International Certified Ratings Program.

D. AMCA 99 – Standards Handbook.

E. AMCA 210 – Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

F. AMCA 300 – Reverberant Room Method for Sound Testing of Fans.

G. AMCA 301 – Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

H. AMCA 500-D – Laboratory Methods of Testing Dampers for Rating.

I. ASHRAE Std 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

J. ASTM B177/B177M – Standard Guide for Engineering Chromium Electroplating.

K. CSA C22,2 #236 – Heating and Cooling Equipment (Bi-National Standard with UL 1995).

L. NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.

M. UL 1812 – Ducted Heat Recovery Ventilators.

N. UL 1995 – Heating and Cooling Equipment.

1.3 SUBMITTALS

A. See Section 230500 “Common Work Results for HVAC” for submittal procedures.

B. Product Data:
1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
4. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Oxygen8.

B. Hakkon Industries.

C. Innovent, a business of Unisom Comfort Technologies.

D. Huntair, Nortek, Inc.

E. Scott Springfield Manufacturing, Inc.

2.2 CASING CONSTRUCTION

A. Full Perimeter Base Rail:
1. Formed and welded steel base, painted.
2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:
1. Construct of one-piece, insulated, 2-inch-thick, double wall panels.
2. Construct outer panels of galvanized steel and inner panels of aluminum.
   a. All non-aluminum interior surfaces exposed to pool return air covered with corrosion resistant coating.
3. Maximum panel deflection shall not exceed L_{250} at design total static pressure.

4. The panel insertion loss, per octave band, shall not be less than the following:
   a. Frequency, Hz:

100	125	250	500	1000	2000	4000	8000

   b. Insertion loss, dB:

24	16	30	32	33	34	63	60

C. Access Doors:
1. Construction, thermal and air pressure performance same as casing.
2. Provide surface mounted handles and stainless-steel piano hinges, swing doors.
3. Pressure relief safety latches on all access doors opening with a positive air pressure.

D. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.

E. Casing Leakage: AHRI 1350 leakage class rating of 5.0.

F. Insulation:
1. 2 pcf polyurethane foam insulation in walls, ceiling, and floor.
2. Provide minimum thermal thickness of 12 R throughout.
3. Completely fill panel cavities in each direction to prevent voids and settling.
4. Comply with NFPA 90A.

G. Drain Pan Construction:
1. Provide heat exchanger core sections with an insulated, double wall, aluminum drain pan complying with ASHRAE Std 62.1 for indoor air quality and sufficiently sized to collect all condensate.
2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.
3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.
4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.

H. Finish:
1. Indoor Units:
   a. Provide exterior, galvanized steel panels coated with high performance polyester finish.
   b. Color: Manufacturer’s standard color.

2.3 FANS, SUPPLY AND EXHAUST

A. Type: Air foil, single width, single inlet, centrifugal, direct drive, plenum type fan with welded aluminum wheel and painted steel frame.

B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

D. Motor: TEFC EISA compliant.

1. Class F insulation

E. Mounting:
1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.
2. Fan statically and dynamically balanced within 0.0785 in/sec peak velocity.
3. Mount base on 1-inch deflection, seismic rated, spring vibration isolators.

F. Motor Wiring Conduit: Factory wire fan motor wiring to the unit-mounted variable frequency drive.

2.4 FIXED-PLATE SENSIBLE HEAT EXCHANGER

A. Certified in accordance with AHRI 1060 (I-P) and UL 1812 for mechanical, electrical, and fire safety.

B. Casing: Aluminum framing and end caps.

C. Plates: Evenly spaced and sealed and arranged for cross-airflow.

D. Plate Material: Smooth aluminum plates separated by formed ribs.

E. Bypass: Plenum within casing.

F. Differential Pressure Gauge:
1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each heat exchanger airstreams to indicate status.
2. Maintain ±5% accuracy within operating limits of 20°F to 120°F.

2.5 AIR FILTERS

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Exhaust Air Filters:
1. Upstream of energy recovery core.
2. Pleated Media: 2-inch, 100% synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
3. Minimum Efficiency Reporting Value: 8 MERV when tested in accordance with ASHRAE Std 52.2.

C. Outdoor Air Filters:
1. Upstream of energy recovery core.
2. Pleated Media: 2-inch, 100% synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
3. Minimum Efficiency Reporting Value: 8 MERV when tested in accordance with ASHRAE Std 52.2.

D. Supply Air Filters:

1. Upstream of coils and supply fan.
2. Pleated Media: 2-inch, 100% synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
3. Minimum Efficiency Reporting Value: 13 MERV when tested in accordance with ASHRAE Std 52.2.

E. Differential Pressure Gauge:
1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
2. Maintain ±5% accuracy within operating limits of 20°F to 120°F.

2.6 DAMPERS

A. AMCA certified performance in accordance with AMCA 500-D.
1. Class 1A low leakage rating of 3 CFM/ft.^{2} at 1-inch w.g.

B. Outside Air Damper: Formed galvanized steel opposed blades with synthetic bearings in galvanized frame. Modulating actuator.

C. Outside Air Heat Exchanger Face/Bypass Dampers: Mechanically interlocked formed galvanized steel opposed blades with synthetic bearings in galvanized frame. Modulating actuator.

D. Recirculation Damper: Airfoil aluminum opposed blades with synthetic bearings in aluminum frame. Modulating actuator.

E. Exhaust Air Damper: Airfoil aluminum opposed blades with synthetic bearings in aluminum frame. Two-position actuator.

F. Damper Actuators: Provided by air-handling unit manufacturer. See "Controls" paragraph.

2.7 ELECTRICAL

A. Unit is ETL listed per UL 1995and CSA C22,2 #236.

B. Single point three-phase power connection with unit mounted disconnect.

C. Power wiring enclosed in conduit.

D. All wires terminated at the unit-mounted NEMA 3R panel.

E. Supply Fan/Exhaust Fan VFDs (with manual bypass) are furnished and installed by air-handling unit manufacturer.
1. Two-contactor manual bypass.
2. VFD enclosure shall have a strip heater and ventilation fan.

2.8 CONTROLS

A. Factory Installed Direct Digital Control (DDC) System:

1. Factory engineer and test each component.
2. Provide fully functional control system to operate in either stand-alone mode or as part of the building automation system (BAS) via single pair of twisted wires tie-in.
3. DDC Controller:
   a. Dedicated, field programmable DDC controller with appropriate point capabilities.
   b. BACnet MS/TP compatible.

B. Factory Provided Controls for Field Installation:
1. Supply air temperature sensor.
2. Room differential pressure sensor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

D. Make connections to coils with unions or flanges.

E. Field-wire each factory provided control for field installation.

3.2 FIELD QUALITY CONTROL

A. See Section 014000 – Quality Requirements, for additional requirements.

B. Coordination of Other Tests and Inspections:
1. Refer to Section 230593.

3.3 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

3.4 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Owner's personnel.
1. Use operation and maintenance data as reference during demonstration.

2. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.

END OF SECTION 237233

SECTION 237433 – DEDICATED OUTDOOR AIR UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Indoor-mounted dedicated outdoor air units (DOAS).

1.2 REFERENCE STANDARDS

A. AHRI 210/240 – Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. AHRI 270 – Sound Performance Rating of Outdoor Unitary Equipment.

C. ASHRAE Std 23 – Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units.

D. ASHRAE Std 90.1 I-P – Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. NFPA 70 – National Electrical Code.

F. UL (DIR) – Online Certifications Directory.

G. UL 207 – Standard for Refrigerant-Containing Components and Accessories, Nonelectrical.

1.3 SUBMITTALS

A. See Section 230500 – Common Work Results for HVAC for submittal procedures.

B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Oxygen8.

B. Greenheck.

2.2 INDOOR-MOUNTED DOAS PERFORMANCE REQUIREMENTS

A. Performance Ratings: ASHRAE Std 90.1, EER and COP as applicable.

B. Regulatory Requirements: AHRI 270 rated, NFPA 70, and UL (DIR) listed.

C. Supply Fan Section:
1. Fan Operation: Constant volume.

D. Electrical: 480 VAC, three-phase, 60 Hz, single point to factory-mounted fused disconnect switch internally wired into motors and compressors, and other powered components including system safeties.

2.3 INDOOR-MOUNTED DOAS

A. Packaged Unit:
1. Casing and Components:
   a. Fabrication: AHRI 210/240 and UL 207 construction, ASHRAE Std 23 tested.
   b. 18-gauge, 0.0478-inch steel panels reinforced with structural angles and channels to ensure rigidity.
   c. Provide bolted access panels to access each sections from either side of unit.
   d. Provide hinged door with lockable handle for serviceable sections.
   e. Drain Pan: Galvanized steel with corrosion-resistant coating.
2. Performance Ratings: ASHRAE Std 90.1, EER and COP as applicable.
3. Regulatory Requirements: AHRI 270 rated, NFPA 70, and UL (DIR) listed.
4. Insulation: Minimum ½-inch-thick acoustic duct liner for lining cabinet interior.
5. External Surface Finish: Heat-resistant baked enamel.

B. Filter Section:
1. Filter: Removable, 4-inches-thick combined MERV-8 and MERV-14.

C. DX Coil Section:
1. Air-Source Heat Pump:
   a. Packaged air-source heat pump with integrated or coordinated controls.
   b. Compressor Section:
      1) Hermetically sealed, direct-driven single-stage scroll or dual-stage scroll type with centrifugal type oil pumps.
      2) Motor: Suction gas-cooled with voltage utilization range of ±10% of unit nameplate voltage.
      3) Internal spring isolation and sound muffling to minimize vibration transmission and noise.
      4) External high-and low-pressure switches.
   c. Refrigerant Load Control: Provide hot-gas bypass and hot-gas reheat coil.
   d. Evaporator Section: Internally finned aluminum, copper, or cupro-nickel tubes mechanically bonded to aluminum plate fins.

D. Fan Section:
1. Provide direct or plenum mounted variable-speed fan motors; see Section 230513.
2. Draw-through, forward-curved fan, constructed of corrosion-resistant, galvanized material and designed for efficient, quiet operation.
3. Factory program for both soft start and constant flow output over static pressure range.
4. Provide preinstalled neutral wire protection when required to support specified fan type.
5. Motor to include thermal overload protection, quick disconnect plug, and permanently lubricated bearings.

6. Belt-Driven Motor Requirements: Provide adjustable blower motor/sheave combination device based on indicated flow performance requirements. Statically and dynamically balanced centrifugal fan mounted on solid steel shaft with heavy duty self-aligning prelubricated ball bearings and V-belt drive with matching motor sheaves and belts.
7. Variable Speed Control: Configure controller to maintain adjustable flow setpoint for modulating or speed-switched units; see Section 230934.
8. Fan Turndown: Design control features to allow fan speed reduction to adjustable 50% of its capacity when the zone set point temperature is satisfied or when unit runs in fan-only mode.

E. Unit Controls:
1. DDC:
   a. Application Specific Controller.
   b. Tested to monitor and handle sequencing functions and other operational modes using field-mounted thermostat and other sensors.
   c. Coordination and Sequencing:
      1) Internal Devices: Include compressors, blower, sensors, switches, valves, safeties, other components.
      2) Field-Installed Devices: Solenoid valves, thermostat, EWT sensors, LWT sensors, internal and remote contacts, and other devices required for operation.
      3) Safeties: At minimum include anti-short-cycle compressor protection, condensate overflow, refrigerant high pressure, refrigerant low pressure, loss-of-charge, refrigerant freeze protection, and freezestat.
2. Thermostat:
   a. Field mounted and wired, tied into prewired control-interface terminals.
   b. Smart Thermostat:
      1) BAS, SCADA, or Integrated Automation linked programmable thermostat.
   c. Programmable Thermostat:
      1) Electro-mechanical type with key- or pushbutton-operated display.
      2) Programmable occupied/unoccupied weekly and holiday schedule.
   d. Nonprogrammable Thermostat:
      1) Electro-mechanical type with key- or pushbutton-operated display.
      2) User-configurable, precoded options aligned with equipment functions.
   e. Thermostat: Single-gang-box-mounted platinum or thermistor.
      1) Local Interface to Include:
         a) Filter maintenance indicating status.
3. Local Control Panel: Interface to include on-off-auto switch, summer-winter switch, heat-off-cool switch, indicating lights for supply fan, pilot operation, burner operation, lockout indication, and clogged filter indication.

F. Electrical: 480 VAC, 3-phase, 60 Hz, single point to factory-mounted nonfused disconnect switch internally wired into motors and compressors, and other powered components including system safeties.

G. Furnish dedicated outdoor air unit and associated components and accessories produced by a single manufacturer.

2.4 OUTDOOR-MOUNTED DOAS

A. Packaged Unit:
   1. Casing and Components:
      a. Fabrication: AHRI 210/240 and UL 207 construction, ASHRAE Std 23.1 tested.
      b. 18-gauge, 0.0478-inch steel panels reinforced with structural angles and channels to ensure rigidity.
      c. Provide bolted access panels to access each sections from either side of unit.
      d. Provide hinged door with lockable handle for serviceable sections.
      e. Drain Pan: Galvanized steel with corrosion-resistant coating.
   2. Performance Ratings: ASHRAE Std 90.1, EER and COP as applicable.
   3. Regulatory Requirements: AHRI 270 rated, NFPA 70, and UL (DIR) listed.
   4. Insulation: Minimum ½-inch-thick acoustic duct liner for lining cabinet interior.
   5. External Surface Finish: Heat resistant baked enamel.
   6. Outdoor Installation: Weatherproofed casing, with intake louver or hood.
   7. Outside Air Damper with Rain Hood and Screen:
      a. Set motorized outdoor air damper(s) to factory-identified preset position to provide up to 30% outside air when fan starts and close 30 seconds after fan stops, adjustable.
      b. Set outdoor air dampers to fully open when fan starts and close 30 seconds after fan stops, adjustable.
      c. Dampers to modulate when unit is on economizer, space pressurization, or CO_2 control.

B. Filter Section:
   1. Filter: Removable, 4-inches-thick MERV-8.
   2. Monitoring: Provide gauge with loaded setpoint-adjustable signal flag, or external tag. Provide loaded filter alarm switch wired into unit controls with illuminated indicator on local control panel face.

C. Heating Section:
   1. Electrical:
      a. Finned tube heating elements easily accessible with automatic reset thermal cut-out, built-in silicone-controlled rectifier (SCR) interface, galvanized steel frame with airflow proving switch, load fuse, manual reset switch, pilot-duty toggle switches, step-down controls transformer, service lights, service GFCI receptacle, and thermal cutout switch.
      b. Controls: Start supply fan before electric elements are energized and continue operating until air temperature reaches minimum setting, with switch for continuous fan operation. Integrate or coordinate controls with unit controller.

D. Fan Section:
   1. Provide direct or plenum mounted variable-speed fan motors; see Section 230513.
   2. Draw-through, forward-curved fan, constructed of corrosion-resistant, galvanized material and designed for efficient, quiet operation.
   3. Factory program for both soft start and constant flow output over static pressure range.
   4. Coordinate fan sequencing for units with return, exhaust, or return-exhaust fan sections.
   5. Provide preinstalled neutral wire protection when required to support specified fan type.
   6. Motor to include thermal overload protection, quick disconnect plug, and permanently lubricated bearings.
   7. Variable Speed Control: Configure controller to maintain adjustable flow setpoint for modulating or speed-switched units; see Section 230934.

8. Fan Turndown: Design control features to allow fan speed reduction to adjustable 50% of its capacity when the zone set point temperature is satisfied or when unit runs in fan-only mode.

E. Unit Controls:
   1. DDC:
      a. Application Specific Controller.
      b. Tested to monitor and handle sequencing functions and other operational modes using field-mounted thermostat and other sensors.
      c. Coordination and Sequencing:
         1) Internal Devices: Include compressors, blower, sensors, switches, valves, safeties, other components.
         2) Field-Installed Devices: Solenoid valves, thermostat, EWT sensors, LWT sensors, internal and remote contacts, and other devices required for operation.
         3) Safeties: At minimum include anti-short-cycle compressor protection, condensate overflow, refrigerant high pressure, refrigerant low pressure, loss-of-charge, refrigerant freeze protection, and freezestat.
      d. Auxiliary Interface: Provide two digital inputs and one analog input, configurable.
   2. Thermostat:
      a. Field mounted and wired, tied into prewired control-interface terminals.
      b. Night Setback: Energize system when space temperature is below the 50°F setpoint, adjustable.
      c. Smart Thermostat:
         1) BAS, SCADA, or Integrated Automation linked programmable thermostat..
         2) Auxiliary Interface: Provide two digital inputs and one digital output, configurable.
      d. Programmable Thermostat:
         1) Electro-mechanical type with key- or pushbutton-operated display.
         2) Programmable occupied/unoccupied weekly and holiday schedule.
      e. Nonprogrammable Thermostat:
         1) Electro-mechanical type with key- or pushbutton-operated display.
         2) User-configurable, precoded options aligned with equipment functions.
      f. Thermostat: Single-gang-box-mounted platinum or thermistor.
         1) Local Interface to Include:
            a) Setpoint adjustment control.
            b) Fan ON-OFF-AUTO control.
            c) Status indicating manual override.
            d) Dial, knob, level, or slider interface.
            e) Filter maintenance indicating status.
   3. Interlocked Functions:
      a. Unit to start when exhaust fan is running.
      b. Timer: Operates fan system on low volume at night.
      c. Low and High Limit Controls: Maintain supply air temperature between set points and shut fan down if temperatures are exceeded. Include manual reset switch.

F. Electrical: 480 VAC, three-phase, 60 Hz, single point to factory-mounted nonfused disconnect switch internally wired into motors and compressors, and other powered components including system safeties.

G. Furnish dedicated outdoor air unit and associated components and accessories produced by a single manufacturer.

H. Accessories: Provide factory installed bipolar air ionizator and ultraviolet germicidal lamp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Connect drain pan outlet to nearest building drain system piping.

C. Adjusting: Use plenum static pressure readings against manufacturer calibration chart to adjust primary airflow as other measuring methods will not work.

D. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote front-end interface.

END OF SECTION 237433

SECTION 238133 – VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. System Operation: Heating and cooling, simultaneously.

B. Provide a complete air-source type variable refrigerant flow (VRF) System consisting of one or more outdoor compressor units and multiple indoor fan coil units as specified in this Section and in accordance with the following:
   1. The complete system must be a tested combination in accordance with AHRI 1230.

C. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.

D. Variable refrigerant flow HVAC system includes:
   1. Outdoor/condensing unit(s).
   2. Indoor/evaporator units.
   3. Branch selector units.
   4. Refrigerant piping.
   5. Control panels.
   6. Control wiring.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

B. AHRI 270 – Sound Performance Rating of Outdoor Unitary Equipment.

C. AHRI 760 (I-P) – Performance Rating of Solenoid Valves for Use with Volatile Refrigerants.

D. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.

E. ASME B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

F. ASME B16.26 – Cast Copper Alloy Fittings for Flared Copper Tubes.

G. ASME B31.5 – Refrigeration Piping and Heat Transfer Components.

H. ASTM B88 – Standard Specification for Seamless Copper Water Tube.

I. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.

J. ASTM B280 – Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

K. ASTM D520 – Standard Specification for Zinc Duct Pigment.

L. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

M. AWS A5.8M/A5.8 – Specification for Filler Metals for Brazing and Braze Welding.

N. AWS Z49.1 – Safety in Welding, Cutting, and Allied Processes.

O. MSS SP-58 – Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

P. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

Q. NFPA 70 – National Electrical Code.

R. UL 429 – Electrically Operated Valves.

S. UL 1995 – Heating and Cooling Equipment.

1.3 SUBMITTALS

A. See Section 230500 “Common Work Results for HVAC” for submittal procedures.

B. Preconstruction Submittals
1. Qualification of installer.
2. Verification of existing conditions.

C. Shop Drawings
1. VRF System Contractor design drawings.

D. Product Data
1. Spare parts data.
2. Coil corrosion protection.
3. Manufacturer’s standard catalog data.
4. Sample warranty.
5. Refrigerant safety data sheets (SDS).

E. Design Data
1. Manufacturer’s engineering data.

F. Test Reports
1. System Performance Tests.

G. Certificates of Service Organizations
1. Warranty
2. Electronic Refrigerant Leak Detector Calibration
3. Ozone Depleting Substances Technician Certification

H. Manufacturer’s Instructions
1. Manufacturer’s instructions.

I. Manufacturer's Field Reports
   1. Refrigerant charging.

J. Closeout Submittals
   1. Posted instructions.

1.4 QUALITY ASSURANCE

A. Complete VRF systems must be purchased from a single supplier. The VRF system supplier must be responsible for providing a fully functional VRF system.

1.5 VRF SYSTEM CONTRACTOR DESIGN DRAWINGS

A. Submit VRF System Contractor Design Drawings in a single transmittal. Equipment layouts must be drawn to scale. Shop drawings must be approved by the VRF manufacturer's representative. Include approval with name and contact information of VRF manufacturer's representative in the submittal. Place separation sheets before each of the following items covering each item with title and number.

B. Equipment layouts which identify assembly and installation details.

C. Identify scheduled items with indicating marks. Include manufacturer's selection report for equipment, components, and fittings.

D. Plans and elevations which identify dimensioned clearances required for maintenance and operation. Show access panels with dimensions.

E. Foundation drawings, bolt-setting information, and foundation bolts.

F. Installation details which include refrigerant type and charge weight for the system (not only the factory-supplied outdoor unit). Indicate factory setpoints for superheat/subcooling, target evaporating/condensing and corresponding refrigerant pressures/temperatures. Also include saturation reset schedule.

G. Refrigerant piping system plans. Piping layouts must be to scale, and piping must have radial and linear dimensions identifying pipe type. Identify each refrigerant circuit and indicate refrigerant type and mass. Indicate piping expansion components and directions of thermal expansion. Piping layouts must be in accordance with ASHRAE Std 15 and ASHRAE Std 34.

H. Schedules of equipment, valves, and manufacturer fittings. Mark each item with a common type identifier and unique number.

I. Calculations for refrigerant mass and pipe expansion.

J. Sequence of Operations of system and components.

K. Calculations demonstrating compliance with ASHRAE Std 15 and ASHRAE Std 34.

1.6 QUALITY CONTROL

A. Qualification of Installer
   1. The installers must be trained and qualified to install the same type of VRF system components to be installed under this contract by the same manufacturer. Include training certificates in submittal. The installer must have performed three complete installations of VRF systems of the same type and manufacturer that resulted in successful commissioning. Include project VRF installation and product information, location, customer contact information and VRF manufacturer representative contact information. The customer and VRF representative will be contacted to validate information given.

B. Ozone Depleting Substances Technician Certification
   1. All technicians working on equipment that contain ozone depleting refrigerants must be certified as a Section 608 Technician to meet requirements in 40 CFR§82, Subpart F. Provide copies of technician certifications to the Architect at least 14 calendar days prior to work on any equipment containing these refrigerants.
   2. If all products do not contain any refrigerants identified in 40 CFR§82, submit all refrigerant SDS sheets and a general statement of exemption from 40 CFR§82in alternate to the certifications. Statement of exemption must indicate all equipment containing refrigerants with respective refrigerant types.

C. Standard Products
   1. Provide materials and equipment that are standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design, and workmanship. The standard products must have been in satisfactory commercial or industrial use for 3 years immediately prior to the solicitation of this contract. The 3-year use includes applications of equipment and materials under similar circumstances and of similar size. The 3 years' experience must be satisfactorily completed by a product which has been sold on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products must be supported by a service organization. Ensure system components are environmentally suitable for the indicated geographic locations.

1.7 MANUFACTURER'S ENGINEERING DATA

A. Submit VRF manufacturer's engineering data with the shop drawings under separate cover. Strike out irrelevant items and options not to be installed. Provide all input and output reports for all selection procedures required by the manufacturer and as required by this section. Engineering data must include:

B. Selection Procedures:
   1. Indoor and outdoor units.
   2. Branch selector units.
   3. Piping material and fittings.
   4. Refrigerant mass for system.
   5. Refrigerant classification.

C. System Efficiency Curves/Data including:
   1. Efficiency correlated with OAT.
   2. At least five (5) data points covering full range of operation
   3. Minimum and maximum values over the operational range

4. Efficiency at Standard AHRI conditions.

1.8 MANUFACTURER'S INSTRUCTIONS

A. Submit VRF manufacturer's instructions with the shop drawings under separate cover. Strike out irrelevant items and options not to be installed. Provide with the following:
   1. Installation: Include mechanical, electrical, controls and piping complete installation requirements.
   2. Operation: Include startup, normal operation, and shutdown procedures.
   3. Maintenance: Include preventative.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Properly protect and care for all material both before and during installation. Submit an inventory of all the stored items. Replace any materials found to be damaged, at no additional cost to the Owner. During installation, keep piping and similar openings capped to keep out dirt and other foreign matter.

1.10 WARRANTY

A. Provide VRF manufactured equipment with the Manufacturer's Standard Warranty in addition to the Warranty of Construction. Submit Sample Warranty prior to construction. Compare warranty requirements with the requirements of this contract and identify discrepancies in the submittal that would prevent coverage of warranty by the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Daikin Industries.

B. LG Electronics.

C. Mitsubishi Electric.

D. Samsung HVAC.

E. Substitutions of equipment or materials shall be made only with written prior approval. Prior approval requests must be received at least ten (10) days prior to bid date unless otherwise instructed. Refer to Section 230500 "Common Work Results for HVAC" for procedures in requesting substitutions.

2.2 MATERIALS

A. Provide Manufacturer's standard catalog data, highlighted to show material, size, options, performance charts and curves, in adequate detail to demonstrate compliance with contract requirements. If field installed vibration isolation is specified for a unit, include vibration isolator literature containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations. Submit data for each specified component.

2.3 PERFORMANCE REQUIREMENTS

A. Energy Efficiency
   1. Provide equipment meeting the efficiency requirements as stated within this section.
   2. Provide energy efficiency curve and data of efficiency vs. OAT. Provide at least five data points over the full range of operation capturing the minimums and maximums.

B. Minimum efficiency requirements must be in accordance with ASHRAE Std 90.1 I-P.

2.4 REFRIGERANT

A. Refrigerants must have number designations and safety classifications in accordance with ANSI/ASHRAE 15 & 34. Refrigerants must have an ozone depletion potential (ODP) no greater than zero, except for R-123. Provide refrigerant safety data sheets (SDS) for all refrigerants.

2.5 SAFETY DEVICES

A. Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel must be insulated, fully enclosed, guarded, or fitted with other types of safety devices.

2.6 CONTROLS

A. Provide the following control interfaces:
   1. Displays the current temperature, temperature setpoint, fans status, occupancy status and conditioning mode at the same time. If information is displayed electronically then it must be illuminated.
      a. Temperature setpoint adjustment in one-degree increments.
      b. Fan's speed control (At least: HIGH-LOW-AUTO).
      c. Occupancy override button which changes the mode of the zone to occupied for one hour per press of occupancy override button with three hours maximum at any instance.
   2. One central remote-control panel for entire system; locate where indicated.
   3. BACnet gateways sufficient to connect all units to building automation system by others; include wiring to gateways.

2.7 INDOOR FAN COIL UNITS

A. Factory complete, tested, and pre-wired with all necessary electronic and refrigerant controls.

B. Equipped with auto-restart function and test run capability either via a switch or controller.

C. Refrigerant: Refrigerant circuits factory-charged with dehydrated inert gas.

D. Coils: Direct expansion type constructed from copper, aluminum, or copper and aluminum.

E. Fans: Direct-drive, with statically and dynamically balanced impellers; variable speed [ECM][or multi-speed supporting at least high and low speeds] unless otherwise indicated; motor thermally protected.

F. Return Air Filter: Washable long-life net filter with mildew proof resin, or replaceable, unless otherwise indicated.

G. Condensate Drainage: Built-in condensate drain pan with drain connection.

H. Dedicated electronic modulating refrigerant expansion and flow control.

I. Unit must be in accordance with UL 1995 and AHRI 1230.

J. For units with built-in condensate pumps, provide condensate safety shutoff and alarm. For units without built-in condensate pump, provide built-in or field supplied overflow protection.

K. Concealed-in-Ceiling Units
   1. Ducted horizontal discharge and return; galvanized steel cabinet.
   2. Field adjustable external static pressure switch for high efficiency filter operation.
   3. Switch box accessible from side or bottom.

L. Recessed Ceiling Units
   1. Four-way airflow cassette with central return air grille, for installation in a fixed ceiling, unless otherwise indicated.
   2. Exposed Housing: White, impact resistant, with washable decoration panel.
   3. Supply Airflow Adjustment:
      a. Via [motorized][manual] louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
      b. Field-modifiable to three-way and two-way airflow.

M. Wall Surface-Mounted Units
   1. Finished white casing, with removable front grille; sound insulation; wall mounting plate; condensate drain pan.
   2. Airflow Control: Auto-swing louver that closes automatically when unit stops; adjustable discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
   3. Fan: Direct-drive crossflow type.
   4. Condensate Drain Connection: Side (end), not concealed in wall.

N. Supplemental Electric Heating Coil
   1. Coil must be an electric duct heater in accordance with UL 1995 and NFPA 70. Coil must be duct- or unit-mounted.
   2. Coil must be provided with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized.

3. Coil casing and support brackets must be of galvanized steel or aluminum. Coil must be mounted to eliminate noise from expansion and contraction and be completely accessible for service.
4. Supplemental Electric Resistance Heating controls must be provided to prevent operation when the heating load can be met by the primary source alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during outdoor coil defrost cycles.

O. Mixing Boxes
1. Mixing boxes must match the base unit in physical size and must include equally sized openings, each capable of full air flow. Arrangement must be as indicated.
2. Dampers must be parallel blade type with renewable blade seals and be integral to the unitary unit. Damper provisions must be provided for each outside air intake, exhaust, economizer, and mixing boxes. Dampers must haveautomatic modulation nd operate as specified.

2.8 BRANCH SELECTOR UNIT

A. Branch Selector port control must be provided for each connected indoor unit to enable individual heating and cooling selection year-round unless otherwise indicated in the contract drawings. The cabinet must be galvanized steel. The branch selector units must be factory assembled, wired, piped, and run tested.

2.9 OUTDOOR COMPRESSOR UNIT

A. The outdoor unit must have one or more variable capacity compressors or alternative method resulting in three or more steps of capacity needed to always load match the indoor unit fan coils.

B. The unit must be factory complete, tested, and pre-wired with all necessary electronic and refrigerant controls.

C. The sound pressure dB(A) at rated conditions must be a maximum value of 58 decibels at 3 feet from the front of the unit when rated in accordance with AHRI 270.

D. The unit must automatically restart normal operation after a power failure of any duration without reprogramming or manual assistance.

E. Oil recovery cycle must be automatic occurring a minimum of 2 hours after start of operation and then at least every 8 hours of operation.

F. Each outdoor unit must have its own dedicated power feed, each with disconnect and main power circuit breaker.

G. The unit must comply with ASHRAE Std 15 and ASHRAE Std 34, and be factory tested, cleaned, dehydrated, charged, and sealed. Provide refrigerant charging valves. Filter-drier must be provided in liquid line.

H. The outdoor unit's capacity must meet or exceed the scheduled value in the contract drawings. The ratio of the outdoor unit capacity to the total connected indoor capacity must be in accordance with the manufacturer's recommendations for selecting the outdoor unit.

I. Unit must be in accordance with UL 1995and AHRI 1230.

J. Air-Cooled
   1. The unit must have full design cooling capacity at 85 degrees F dry bulb ambient.
   2. For units other than cooling only, the unit must have full design heating capacity at 17 degrees F dry bulb ambient.

K. Casing
   1. Construct the unit of zinc coated, heavy-gage (14-gage minimum) galvanized steel. Provide cabinet panels with lifting handles and water- and air-tight seal. Insulate all exposed vertical panels, top covers, and base pan.

L. Compressor
   1. Each compressor system must have the following:
      a. High pressure safety switch, and internal thermal overload protection.
      b. Factory installed vibration dampeners on all mounting points.
      c. Factory installed crank case heater or other control logic to ensure reliable operation in freezing environments.
      d. Oil separator with an oil balance circuit.

M. Coil Frost Protection (Defrost Mode)
   1. Provide each circuit with a manufacturer's standard coil frost protection (Defrost Mode) system.

2.10 REFRIGERANT PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Flared.

C. Provide pipe insulation in accordance with 23 07 19, HVAC PIPING INSULATION.

2.11 CONDENSATE DRAIN PIPING

A. Copper tube, ASTM B88M, Type M, hard-drawn temper.
   1. Fittings: ASME B16.22 wrought-copper or ASME B16.18, cast-copper alloy solder-joint pressure fittings.

B. Provide pipe insulation in accordance with 23 07 19, HVAC PIPING INSULATION.

2.12 REFRIGERANT SOLENOID VALVES

A. Solenoid valves must comply with AHRI 760 (I-P) and UL 429, be suitable for continuous duty rated voltage at maximum and minimum encountered pressure and temperature service conditions. Solenoid valves must be direct-acting or pilot-operating type, packless, seal capped. Manual lifting provisions must be furnished. Solenoid coils must comply with NEMA 250 type 4. Valves must have safe working pressure of 125 percent of maximum working pressure and a maximum operating pressure differential of at least half of the valve maximum working pressure at 85 percent rated voltage. Valves must have an operating pressure differential suitable for the fluid phase and refrigerant used.

2.13 REFRIGERANT SIGNS

A. Refrigerant signs must be a medium-weight aluminum type with a baked enamel finish. Signs must be suitable for indoor or outdoor service. Signs must have a white background with red letters not less than 0.5 inches in height.

2.14 INSTALLATION IDENTIFICATION

A. Provide each new refrigeration system with a refrigerant sign which indicates the following as a minimum:
   1. Contractor’s name.
   2. Refrigerant number and amount of refrigerant.
   3. The lubricant identity and amount.
   4. Field test pressure applied.

2.15 CONTROLS AND PIPING IDENTIFICATION

A. Provide refrigerant systems containing more than 110 lbs. of refrigerant with refrigerant signs which designate the following as a minimum:
   1. Valves or switches for controlling the refrigerant flow [, the ventilation system,] and the refrigerant compressor.
   2. Pressure limiting device(s).

2.16 EQUIPMENT AND COMPONENTS FACTORY COATING

A. Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, must be factory finished with the manufacturer’s standard finish, except that item located outside of buildings must have weather resistant finishes that will withstand [100] [500] hours exposure to the salt spray test specified in ASTM B117. Immediately after completion of the test, the specimen must show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used must be coated with a zinc-rich coating conforming to ASTM D520520, Type I.

2.17 FACTORY APPLIED INSULATION

A. Refrigeration equipment must be provided with factory installed insulation on surfaces subject to sweating including the suction line piping. Where motors are the gas-cooled type, factory installed insulation must be provided on the cold-gas inlet connection to the motor in accordance with manufacturer's standard practice.

B. Factory insulated items installed outdoors are not required to be fire-rated.

C. As a minimum, factory insulated items installed indoors must have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces must have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes must be determined by ASTM E84. Insulation must be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket must be tested as a composite material. Jackets, facings, and adhesives must have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. After becoming familiar with all details of the work, submit verification of existing conditions at least 2 weeks prior to beginning construction, indicating the date the site was visited, confirming existing conditions, and noting any discrepancies found.

3.2 INSTALLATION

A. The VRF system must be installed by the contractor identified in Qualification of Installer. The contractor must install the VRF system in accordance with the manufacturer's instructions and Shop Drawings.

B. Equipment General
   1. Provide necessary supports for all equipment, appurtenances, and pipe as required. Isolate outdoor units from the building structure. Equipment must be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions. Air-source outdoor units must be installed per manufacturer's recommendations and must not blow air in the direction of other outdoor unit intakes.

C. Safety Devices
   1. Safety devices must be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements must be in accordance with AWS Z49.1.

D. Controls
   1. Install controls as indicated by the Points Schedule and to provide the following functionality:
      a. On/Off selection for each individual fan coil unit and group.

b. Temperature set point adjustment for each fan coil unit.
c. Fan speed adjustment for each fan coil.
d. Heat/cool/automatic changeover mode selection for indoor and outdoor units.
e. Priority settings for restriction of local access for start/stop, heat/cool mode and set point adjustment.
f. Temperature limitation in both heating and cooling mode.
g. Weekly occupancy schedule with startup and shut off times, temperature settings and operation modes. Yearly occupancy schedule for holidays and periods of non-use.
h. Reset for non-blocking malfunction codes and maintenance warnings.

2. Provide a Local Display panel as indicated on the points schedule and to provide access to the above specified functionality. The Local Display Panel must additionally indicate current date and time.

E. Electrical Equipment / Motors
1. Install electrical equipment, motors, motor efficiencies, and wiring in accordance with Division 26 Electrical.

F. Branch Selector Unit
1. Locate Branch Selector Units inside of the facility with full access for inspection, maintenance, and removal. Locate no more than 6 feet above finished floor. The unit must have a minimum clearance of 12 inches from all serviceable sides and be removable without modification to the surroundings.

G. Access Panels
1. Provide access panels for all concealed equipment, valves, controls, dampers, refrigerant fittings, and other fittings for inspection, maintenance, and removal. Size panel large enough as to be able to remove the part without modification or damage to the surroundings.

H. Air Filters
1. Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air. Providing documentation showing that after construction ends, and prior to occupancy, new filters were provided and installed.

I. Flashing and Pitch Pockets
1. Provide flashing and pitch pockets for equipment supports and roof penetrations and flashing where piping or ductwork passes through exterior walls in accordance with Section 076000 “Flashing and Sheet Metal.”

J. Identification Tags and Plates
1. Provide equipment, gages, thermometers, valves, and controllers with tags numbers stamped or engraved into the material for their use. Provide plates and tags of brass or suitable nonferrous rigid material, securely mounted or attached. Provide minimum letter and numeral size of ⅛-inch high.

K. Refrigerant Signs
1. Locate refrigerant signs within reading distance of outdoor unit.

L. Field Applied Insulation
1. Apply field applied insulation as specified in Section 230719 “HVAC Piping Insulation,” except as defined differently herein.

M. Pipe Hangers and Supports
1. Design and fabrication of pipe hangers, supports, and welding attachments must conform to MSS SP-58. Installation of hanger types and supports for bare and covered pipes must conform to MSS SP-58 for the system temperature range. Unless otherwise indicated, horizontal and vertical piping attachments must conform to MSS SP-58.

N. Refrigerant Piping
1. Cut pipe to measurements established at the site and work into place without springing or forcing. Install piping with sufficient flexibility to provide for expansion and contraction due to temperature fluctuation and as indicated in shop drawings. Where pipe passes through building structure pipe joints must not be concealed but must be located where they may be readily inspected.
2. Install piping to be insulated with sufficient clearance to permit application of insulation. Install piping as indicated and detailed, to avoid interference with other piping, conduit, or equipment. Except where specifically indicated otherwise, run piping plumb and straight and parallel to walls and ceilings. Provide sleeves of suitable size for lines passing through building structure.
3. Braze refrigerant piping with silver solder complying with AWS A5.8M/A5.8. Inside of tubing and fittings must be free of flux. Clean parts to be jointed with emery cloth and keep hot until solder has penetrated full depth of fitting and extra flux has been expelled. Cool joints in air and remove flame marks and traces of flux. During brazing operation, prevent oxide film from forming on inside of tubing by slowly flowing dry nitrogen through tubing to expel air. Make provisions to automatically return oil on halocarbon systems. Installation of piping must comply with ASME B31.5.
4. All refrigerant lines external to units must be isolated from system vibrations including those generated by compressors, fans, or pumps, to minimize the risk of refrigerant leaks.

O. Auxiliary Drain Pans, Drain Connections, and Drain Lines
1. Provide condensate removal through gravity flow where possible. Where gravity flow is not possible, provide a condensate pump sufficient ensure complete removal of condensate.
2. Provide auxiliary drain pans under units located above finished ceilings or over mechanical or electrical equipment. Pan must extend beyond the limits of the units. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening.

3.3 REFRIGERANT PIPING TESTS

A. Perform refrigerant piping tests in accordance with ASHRAE Std 15 and per manufacturer’s recommendations. Use electronic type leak detector with a sensitivity of 0.1 ounces/year and a calibrated reference leak rated at 0.17 ounces/year. Submit current electronic refrigerant leak detector calibration certificate prior to testing. Before testing the refrigerant piping system, perform a test of the leak detector with the reference leak fitting.

3.4 REFRIGERANT CHARGING

A. After refrigerant piping test and before system performance test, perform evacuation and dehydration procedures in accordance with manufacturers recommendations. Evacuate system to a minimum of 0.004 inches Hg for one hour or per manufacturers requirements. Use fresh oil in the vacuum pump. Connect electronic vacuum gauge to system piping for measurement. The refrigerant must be to the weight specified in the shop drawing calculations. The supplemental refrigerant must be weighed in with an electronic scale. Supplemental refrigerant must be introduced to the system in a liquid state for refrigerant blends. Submit refrigerant charging report before system performance test. Outline refrigerant charging procedures in the report. Report must indicate who performed and witnessed the task. Provide signatures from all parties.

3.5 SYSTEM PERFORMANCE TESTS

A. Before each VRF system is accepted, conduct tests to demonstrate the general operating characteristics of the VRF. Submit electronic copies of the report as PDF format. The report must document compliance with the specified performance criteria upon completion and testing of the system. The report must indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. Include manufacturer commissioning report for each VRF system.

B. For equipment providing heating and cooling the system performance tests must be performed during the heating and cooling seasons. For systems capable of simultaneous heating and cooling, perform testing of this mode.

C. Submit a schedule, at least 2 weeks prior to the start of related testing, for the system performance tests. The schedules must identify the proposed date, time, and location for each test. Tests must cover a period of not less than 48 hours for each system and must demonstrate that the entire system is functioning in accordance with the drawings and specifications.

D. Make corrections and adjustments, as necessary, tests must be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, install and tighten service valve seal caps and blanks over gauge points.

E. If tests do not demonstrate satisfactory system performance, correct deficiencies, and retest the system. Conduct tests in the presence of the Architect. Provide all material, equipment, instruments, and personnel required for the test.

F. Coordinate field tests with Section 230800 “Commissioning of HVAC.” The report must document compliance with the specified performance criteria upon completion and testing of the system. The report must indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. Submit the report including the following information (where values are taken at least three different times at outside dry-bulb temperatures that are at least 5°F apart):
   1. Date and outside weather conditions.
   2. The load on the system based on the following:
      a. The refrigerant used in the system.
      b. Condensing temperature and pressure.
      c. Suction temperature and pressure.
      d. Ambient, condensing and coolant temperatures.
      e. Running current, voltage, and proper phase sequence for each phase of all motors.

3. The actual on-site setting of operating and safety controls.
4. Electronic expansion valve superheat - value as determined by field test.
5. Subcooling.
6. High and low refrigerant temperature switch set-points
7. Low oil pressure switch set-point.
8. Defrost system timer and thermostat set points.
9. Moisture content.
10. Capacity control set-points.
11. Field data and adjustments which affect unit performance and energy consumption.
12. Field adjustments and settings which were not permanently marked as an integral part of a device.

3.6 CLEANING

A. Equipment must be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters must be provided for all fans that are operated during construction, and new filters must be installed after all construction dirt has been removed from the building. System must be maintained in this clean condition until final acceptance. Bearings must be properly lubricated with oil or grease as recommended by the manufacturer. Belts must be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment must be adjusted to setting indicated or directed. Fans must be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.7 CLOSEOUT ACTIVITIES

A. Provide closeout activities in addition to and in accordance with Section 230505 “Project Closeout for HVAC”.

B. Extra Materials
   1. Submit spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 2 months prior to the date of beneficial occupancy. Include in the data a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

C. Maintenance Service Providers
   1. Submit a certified list of qualified permanent service organizations, which includes their addresses and qualifications, for support of the equipment. The service organizations must be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

D. VRF Operation and Maintenance Manual

E. Provide the following in addition to and accordance with Section 230505 “Project Closeout for HVAC”.:
      a. Condensed operating instructions listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown.

b. Manufacturer's Engineering Data.
c. Manufacturer's Instructions.
d. Shop Drawings on 11-inch by 17 inch sheets.

3.8 POSTED INSTRUCTIONS

A. Submit the field posted instructions, at least 2 weeks prior to construction completion. Including equipment layout, wiring and control diagrams, piping, valves, and control sequences, and typed condensed operation instructions on one sheet of paper. The condensed operation instructions must include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions must cover all the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations. The posted instructions must be framed under glass or laminated plastic and be posted where indicated by the Architect.

3.9 TRAINING

A. Provide training, for all items provided under this section, in addition to and accordance with Section 230505 "Project Closeout for HVAC." Also include refrigeration leak detection and leak detection response training. The training period must consist of a total 8 hours of normal working time for items covered in this section.

END OF SECTION 238133

CONSTRUCTION SPECIFICATION

9901 24th PLACE WEST
EVERETT, WA

SNOHOMISH COUNTY WEST PRECINCT SHERIFF'S OFFICE TI
Project No. 221016-005

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PREPARED BY: CASNE ENGINEERING, INC.
3545 Factoria Blvd SE, Site 200
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SECTION 26 01 00 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 SECTION INCLUDED

A. Formatting manual submittals

B. Compiling product data and related information appropriate for owner's maintenance and operation.

1. Modifying data as required to accurately represent completed installations.

C. Instructing Owners personnel in maintenance, equipment, and systems operations prior to Owners acceptance of any portion or stage of the work.

D. For additional data requirements see respective specification sections.

1.02 RELATED SECTIONS

A. Coordinate related requirements specified in other parts of the Project Manual, including but not limited to the following:

1. Section 01 78 23 – Operation and Maintenance Data

2. Division 26 – Electrical

1.03 FORM OF SUBMITTALS

A. Prepare data in instructional manual form for use by owner's personnel.

B. Format:

1. Size: 8-1/2 X 11 inches

2. Paper: 20 lb. minimum; white for typed pages

3. Tests: Manufacturers printed data or neatly type written information on 20lb paper.

4. Drawings:

a. Provide reinforced punched binder tab, bound in with text.

b. Fold oversized drawings and place in pocket glued to inside of back cover.

5. Arrange content by systems, under section numbers and sequence of table of contents is Project Manual.

6. Provide flyleaf for project and major component parts of equipment followed by typed descriptions. Provide indexed tabs.

7. Cover: Identify each volume with typed or printed title:

a. "Operation and Maintenance Instructions"

8. Identify the following:

a. Title of project, names of Owner, Engineer, Contractor, Subcontractor, subject matter and completion date of Contract.

b. Identify general subject matter included in the Manual.

C. Binder:

1. Commercial quality, 8-1/2 x 11 inch, 3 ring binder with durable hardback and cleanable plastic covers
2. Maximum ring size: As suitable to content, 3-inch maximum.
3. When multiple binders are used, correlate data into related groupings.

1.04 CONTENTS OF MANUALS

A. Neatly typewritten table of contents: Arrange systematically in relation to Project Manual Table of Contents. Include following information:
   1. Project title
   2. Engineer
   3. Contractor - name of responsible principal, address and telephone.
   4. An indexed list of each product and system data sheets.
   5. Show for each product the name, address and telephone number of the responsible.
      a. Subcontractor or installer
      b. Maintenance contractor, as applicable
   6. Clearly identify by name and other symbols products and component parts as set forth in the Contract Documents.

B. Product data:
   1. Submit original product literature only. Copies are not acceptable.
   2. Include only sheets pertinent to specific product.
   3. Annotate each sheet to:
      a. Clearly identify specific product or part installed.
      b. Clearly identify data applicable to installation
      c. Delete inapplicable information.
   4. Coordinate identification of equipment to match the construction documents.

C. Drawings:
   1. Supplement product data with Drawings required to clearly illustrate
      a. Control and flow diagrams.
      b. Relations of component parts of equipment systems.

D. Supplement product and installation data with service schedule.
   1. Organize in consistent format under separate headings for different service procedures.
   2. Instances that might affect validity of warranties and bonds.

E. Provide a copy of each warranty, bond and service contract issued.
   1. Provide information sheet for Owners personnel. Indicate:
      a. Proper procedures in event of failure.
      b. Instances that might affect validity of warranties and bonds.

1.05 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Each item of equipment and each system: Include description of unit or system and component parts. Give function, normal operating characteristics and limiting conditions. Include performance curves with engineering data and tests. Include complete nomenclature and commercial number of replaceable parts.

B. Panelboard circuit directories: Provide electrical service characteristics, controls and communications.

C. Include "as-installed color-coded" wiring diagrams.

D. Operating procedures: Include start up, break in and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown and emergency instructions. Include summer/winter, and any special operating instructions.

E. Maintenance requirements: Include routine procedures and guide for trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing and checking instructions or complete replacement, as required.

F. Provide servicing and lubrication schedule. List lubricants required.

G. Include manufacturers printed operation and maintenance instructions

H. Include sequence of operation by controls manufacturer

I. Provide original manufacturers parts list, illustrations, assembly drawings and diagrams required for maintenance.

J. Provide as installed control diagrams by controls manufacturer.

K. Provide list of original manufacturers spare parts, current prices and recommended quantities to be maintained in storage.

L. Additional requirements: As specified in individual specifications section.

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

1.06 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owners designated personnel in operation, adjustment and maintenance of products, equipment and systems at agreed upon time. Demonstrate for equipment requiring particular seasonal operation. Perform instructions for other seasons within 6 months.

1.07 SUBMITTALS

A. Submit one copy of completed volumes in final form 45 days prior to final inspection. A copy will be returned after final inspection with Construction Managers and Engineers comments. Revise content of documents as required before final submittal.

B. Submit five copies of revised volumes of data in final form within 10 days after final inspection.

1.08 PREVENTATIVE MAINTENANCE INSTRUCTIONS

A. Prepare preventative maintenance instructions. Include for each piece of equipment or system furnished, requiring periodic inspections, lubrication, adjustment and the like. Insure optimum and continued performance as originally specified.

1. Preventative maintenance instructions: Prepare on form acceptable to Owner.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

SECTION 26 05 11 - DEMOLITION OF ELECTRICAL COMPONENTS

PART 1 - GENERAL

1.01 SUMMARY

A. The demolition work consists of but is not limited to proper removal and disposal of existing electrical conduit, wire, boxes, equipment, fixtures, etc.

1.02 STATEMENT OF WORK

A. All demolition work shall be conducted so that disruption of the current operations in the existing facility is minimized.

1.03 DISPOSAL OF PRODUCTS OF DEMOLITION

A. All materials and equipment removed during demolition shall be properly disposed of unless otherwise noted for salvage. All fees for disposal of equipment and material shall be paid by contractor at no additional charge to owner. All residues (oil, dirt, etc.) shall be removed from material before they are transported. The Contractor shall be responsible for obtaining any and all necessary permits and shall comply with all applicable codes laws and standards.

1.04 DEFINITIONS

A. Remove – Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage – Items indicated to be removed and salvaged remain the Owner's property. Carefully remove and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area on site.

C. Remove and Reinstall – Carefully remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same location or in locations indicated.

D. Existing to Remain – Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Owner, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for removing, patching and extending work: as specified in individual Sections.

PART 3 - EXECUTION

3.01 DEMOLITION WORK ITEMS

A. The Contractor shall visit the site and visually examine the items to be removed in order to determine the exact extent of the work required.

3.02 GENERAL DEMOLITION

A. The Contractor shall exercise extreme caution in conducting all demolition operations to avoid damage to adjacent equipment and structures. During demolition the Contractor shall provide temporary bracing as required to prevent unintentional collapse of equipment and conduit. All areas where demolition activities are to take place shall be marked and separated to avoid injury and damage.

B. All equipment shall be removed in such a manner to assure that associated piping, wiring and other assemblages are not damaged.

C. Damaged equipment and piping due to Contractor's demolition work shall be removed and replaced at no additional cost to the owner.

3.03 COORDINATION AND SCHEDULING

A. The Contractor shall schedule and coordinate demolition work with the building personnel and the Construction Project Manager. The request for downtime shall be submitted to the owner 14 days prior to the planned commencement of work. The owner will notify the Contractor of the approval or denial of the request for downtime 24 hours prior to the planned commencement of work.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Building wire

B. Cable

C. Wiring connections and terminations

1.02 REFERENCED STANDARDS

A. NEMA WC 3 Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

B. NEMA WC 5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

C. NEMA WC 7 Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

1.03 SUBMITTALS

A. Submit Shop Drawings and product data under the provisions of Section 01 33 00.

PART 2 - PRODUCTS

2.01 BUILDING WIRE

A. Thermoplastic-insulated building wire. NEMA WC 5.

B. Rubber-insulated building wire: NEMA WC 3.

C. Feeders and branch circuits indoors 12 AWG and larger: Copper stranded, conductor, 600 volt insulation, THHN/THWN/THWN-2 stranded copper wire with a Maximum Operating Temperature rating of 90°C. Feeders 3/0 and larger may use THW insulation.

D. Feeders and branch circuits outdoors, underground 12 AWG and larger: Copper stranded, conductor, 600 volt insulation, XHHW-2 stranded copper wire.

E. Control circuit conductors in control panels type MTW stranded copper minimum size #18.

F. Control circuit conductors in switchgear type SIS stranded copper.

G. Conductors from all VFD’s to controlled motor shall be run in XHHW-2 insulated conductors

2.02 NONMETALLIC SHEATHED CABLE

A. Service entrance cable: Copper conductor, 600-volt insulation, Type USE.

2.03 REMOTE CONTROL AND SIGNAL CABLE

A. Control cable for Class 1 remote control and signal circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together and covered with an overall PVC jacket.

B. Control cable for Class 2 or Class 3 remote control and signal circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together and covered with a PVC jacket, UL listed.

C. Plenum cable for Class 2 or Class 3 remote control and signal circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together and covered with a non-metallic jacket; UL listed for use in air-handling ducts, hollow spaces used as ducts, and plenums.

PART 3 - EXECUTION

3.01 GENERAL WIRING METHODS

A. Use wire no smaller than 12 AWG for power and lighting circuits and wire no smaller than #18 AWG for control wiring.

B. Use 10 AWG conductor for 20-ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20-ampere, 277-volt branch circuit home runs longer than 200 feet.

C. Use a dedicated neutral conductor of the same gage as the phase wire for each branch circuit on a single-pole circuit breaker.

D. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

E. Use equal conductor lengths for parallel circuits.

F. Splice only in junction or outlet boxes.

G. Neatly train and lace wiring inside boxes, equipment, and panel boards.

3.02 WIRING INSTALLATION IN RACEWAY

A. Pull all conductors into a raceway at the same time. Use UL-listed wire-pulling lubricant for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been protected from the weather and mechanical work likely to injure conductors.

C. Completely and thoroughly swab raceway system before installing conductors.

3.03 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Support cables above accessible ceilings; do not rest on ceiling tiles. Use spring metal slips or plastic cable ties to support cables from structure or ceiling suspension system. Include bridle rings or drive rings.

C. Use suitable cable fittings and connectors.

3.04 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

C. Use split bolt connectors for copper wire splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150% of the insulation value of conductor.

D. Thoroughly clean wires before installing lugs and connectors.

E. Make splices, taps and terminations to carry full capacity of conductors without perceptible temperature rise.

F. Terminate spare conductors with electrical tape.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque test conductor connections and terminations to manufacturer's recommended values.

D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

3.06 WIRE AND CABLE INSTALLATION SCHEDULE

A. Use building wire in raceways for concealed and exposed interior locations, above accessible ceilings, in wet or damp interior locations, in exterior locations, and underground.

3.07 CABLE IDENTIFICATION

A. Provide cable identification as specified in Section 26 05 53 – Identification for Electrical Systems

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and Division 1 Specification Sections, apply to the Work as if specified in this Section.

1.02 REFERENCES

A. ASTM B8.

B. NFPA 70 (National Fire Protection Association) - National Electrical Code.

C. ANSI/UL 96 - (Underwriter's Laboratory) - Lightning Protection Components.

D. ANSI/UL 467 - (Underwriter's Laboratory) - Grounding and Bonding Equipment.

E. ANSI/NFPA 780 - (National Fire Protection Association) - Installation of Lightning Protection Systems.

1.03 QUALITY ASSURANCE

A. Listing and Labeling: Provide electrical components, devices, and accessories that are Listed and Labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authority Having Jurisdiction, and marked for specific types, sizes, and combinations of conductors and connected items.

B. Comply with IEEE 837 and UL 467.

C. Comply with IEEE Std. 142.

D. Comply with NFPA 70.

E. Comply with IEEE C2 for overhead-line construction and medium-voltage underground construction.

F. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

1.04 SUBMITTALS

A. Submit product data for the following:

1. Grounding conductors and cables.

2. Grounding connectors and rods.

3. Grounding electrodes.

4. Ground bus.

B. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.

2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductor Fittings:
    a. Erico Inc.
    b. Chance/Hubbell.
    c. Copperweld Corp.
    d. Erico Inc.; Electrical Products Group.
    e. Framatome Connectors/Burndy Electrical.
    f. Ideal Industries, Inc.
    g. ILSCO.
    h. Kearney/Cooper Power Systems.
    i. Lyncole XIT Grounding.
    j. O-Z/Gedney Co.
    k. Raco, Inc.; Division of Hubbell.
    l. Thomas & Betts, Electrical.
2. Grounding Connectors and Rods:
    a. Erico.
    b. ILSCO.
    c. Lyncole XIT Grounding.
    d. O-Z/Gedney.
    e. Raco, Inc.; Division of Hubbell.
    f. Thomas & Betts.

2.02 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 26 05 19 Low Voltage Electrical Power Conductors and Cables.

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: Bare, tinned, stranded.

G. Bare Copper Conductors: Assembly of stranded conductors, ASTM B 8.

H. Copper Bonding Conductors:

1. Bonding Conductor: #4 or #6 AWG, stranded copper conductor, sized per drawings.

2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

I. Bonding Straps: Soft copper.

J. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

K. Grounding Clamp: Stewart R. Browne, part #ALS-10B.

2.03 CONNECTORS

A. Pressure Connectors: High-conductivity-plated units.

B. Bolted Connectors: Heavy-duty, bolted-pressure-type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.04 GROUNDING ELECTRODES

A. Ground Rods: Solid copper clad steel, 3/4-inch diameter by 10-feet segmented length, minimum 30 feet.

B. Plate Electrodes: Minimum 0.10-inch thick copper.

C. Provide additional 10-foot lengths to segmented Ground Rod until minimum testing requirements are met.

PART 3 - EXECUTION

3.01 APPLICATION

A. Copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Ground Rod Clamps at Manholes: Use bolted pressure clamps with at least two bolts or exothermic welded connection. Provide submittal with proposed connection for approval.

F. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

G. Underground Grounding Conductors: Copper conductor, #4/0 minimum. Bury at least 29 inches below grade or bury just below Duct Bank or tied to spacers in concrete when installed as part of the Duct Bank.

3.02 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and branch circuits unless otherwise noted.

C. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

E. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

F. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120V and higher, including air cleaners and heaters. Bond conductor to each unit and to air duct.

G. Water Heater, Heat-Tracing, and Anti-Frost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

H. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide #4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4 inch x 2 inch x 12 inch grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

I. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors. Reference Division 26, Section 26 56 00 - Exterior Lighting.

J. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

3.03 BUILDING PERIMETER GROUND

A. Ground the steel framework of buildings with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet apart.

B. Provide a perimeter grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Bury counterpoise not less than 29 inches below grade and 36 inches from building foundation.

3.04 INSTALLATION

A. Ground Rods:

1. Drive ground rods until tops are 2 inches (2") below finished floor or final grade.

2. Drive segmented ground rods to minimum of 30 feet and test for resistance. Add segments to ground rods until desired resistance before making final weld connection.

3. Interconnect ground rods with grounding electrode conductors as indicated on drawings. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment.

1. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp.

2. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts.

3. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building.

1. Connect grounding conductors to main metal water service pipes by grounding clamp connectors.

2. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting.

3. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Gas Piping: Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

G. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

3.05 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For #8 AWG and larger, use pressure-type grounding lugs. #10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Non-contact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing.
1. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing.
2. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals per manufacturer's published torque-tightening values.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the grounding conductor.

H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.06 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Duct Banks: Install #250 kcmil bare copper system grounding conductor embedded in the concrete of each medium-voltage Duct Bank or buried directly below the Duct Bank. Provide a ground conductor with each medium-voltage feeder circuit sized per NEC.

B. Connections to Manhole Components: Connect all exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole to ground loop conductor.
1. Make connections with #2 AWG minimum, stranded, hard-drawn copper conductor.
2. Train conductors level or plumb around corners and fasten to manhole walls.
3. Make connection to cable shield as recommended by manufacturer of splicing and termination kits.

4. Connect continuous ground cable in duct bank and equipment grounding conductor in each conduit to ground loop.

C. Pad-Mounted Transformers Generators and Switches: Install four ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than #4/0 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation.

3.07 IDENTIFICATION

A. Identify grounding system components as required by the Authority Having Jurisdiction and as specified in Section 26 05 33.

3.08 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

a. Measure ground resistance without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Test by one of the following methods for resistance measurement:

1) Perform fall of potential test per IEEE Standard No. 81, Section 9.04 on the main grounding electrode or system for each substation and building.

2) Perform the two-point method test per IEEE No.81 Section 9.03 to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral and/or derived neutral points.

3) Alternate Method: Perform ground continuity test between main ground system and equipment frame, system neutral and/or derived neutral point. Conduct test by passing a minimum of ten amperes dc current between ground reference system and the ground point to be tested. Measure voltage drop and calculate resistance by voltage drop method.

c. Test Requirements:

1) Equipment Rated 500 kVA and Less: 10 ohms.

2) Equipment Rated 500 to 1000 kVA: 5 ohms.

3) Equipment Rated More Than 1000 kVA: 3 ohms.

4) Substations and Pad-Mounted Switching Equipment: 5 ohms.

5) Manhole Grounds: 10 ohms.

6) Ground Rods (isolated): 25 ohms.

7) Ground Ring System: 5 ohms.

d. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Resident Engineer promptly and include recommendations to reduce ground resistance.

2. Record test results on Ground Resistance Test Report form.

B. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes.

1. Identify each ground rod by letter in alphabetical order, and key to the record of tests and observations.

2. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results.

3.09 IDENTIFICATION

A. Refer to Section 26 08 01 – Electrical Testing

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Field fabricated raceway support.

B. Equipment support systems.

C. Fixture supports.

D. Fastening of free-standing equipment.

E. Fastening hardware

1.02 RELATED SECTIONS

A. Section 03 30 00 -Cast-in-Place Concrete: Concrete equipment (housekeeping) pads.

B. Section 05 12 00 -Structural Steel

1.03 REFERENCED STANDARDS AND CODES

A. D38001-15 Seismic Design Criteria

B. IBC International Building Code (edition as enforced by the AHJ).

1.04 QUALITY ASSURANCE

A. Welding: Certified welder.

B. Seismic requirements Non-structural Anchorage. Conform to IBC requirements.

1.05 SUBMITTALS

A. Product data.

B. If support systems are not shown on the Drawings, or if alternate support systems are proposed as a cost savings to those support systems shown on the Drawings, submit the following information:

1. Details and assembly of framing to be field erected for support systems.

2. Design of trapeze systems including capacity to carry additional raceway for the most stringent of the following requirements.

a. Raceway space on the trapeze cross member to carry an additional 25% (minimum) raceway.

b. Raceway space on the trapeze cross member for two additional raceways of the largest raceway size.

c. Trapeze cross member long enough to provide space for 18 inches of raceway space.

d. A two-level trapeze system if space required for a trapeze cross member is longer than 24 inches of raceway space.

3. Engineering calculations for seismic bracing bearing the seal and signature of a Professional Engineer licensed in the State of Washington.

1.06 COORDINATION

A. Coordinate location of utility runs and anchors with other trades. Utilize details and dimensions shown on drawings. Where field conditions prohibit, ask for direction from Construction Manager.

1.07 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference one week prior to commencing work of this Section. See Section 01 31 00.

B. Require attendance of parties directly affecting work of this Section.

C. Review conditions of installation, installation procedures, and coordination required with related work.

PART 2 - PRODUCTS

2.01 MATERIAL FOR SUPPORT SYSTEMS IN GENERAL

A. Channel, 1-5/8 x 1-5/8-inch formed from 12-gauge steel, unless otherwise shown, galvanized for exterior locations, galvanized for interior locations.

B. Beam clamps: Galvanized or painted steel to match channel.

1. Partial list of approved beam clamps used in pairs only:

a. B-Line B441-22

b. B-Line B441-22A

c. Superstrut U-501

d. Superstrut U-502

e. Unistrut P2785

f. Unistrut P2786

g. Unistrut P1379S

h. Submit others for review.

2. Partial list of beam clamps approved for use with threaded rods:

a. B-Line B751-J4

b. B-Line B751-J6

c. B-Line B751-J9

d. B-Line B751-J12

e. Superstrut U-569

f. Unistrut P2824-6

g. Unistrut P2824-9

h. Unistrut P2824-12

i. Submit others for review.

C. Threaded rod with carrying capacities per ASTM A36, A575 or A576, 1/2-inch diameter minimum or size as noted on Drawings.

1. For individual conduit runs of 1" and smaller, 3/8-inch threaded rod is acceptable.

D. Fittings: Same material and finish as the channel. (Unistrut numbers used for illustration, similar units by other manufacturers are acceptable).

1. Fittings for attaching channel to channel for built-up framing. Unless otherwise shown, attach fittings to vertical members with two bolts. Partial list of approved fittings follows:

P6028	P6962	P6291	P6346
P6358A	P6069	P6331	P6382
P6359	P6033	P6326	P6381
P6726A	P6290	P6332	P6917

2. Fittings used for bracing:

P6186	P6546	P7097	P7098
P7100	P7101	P7108	P7109
P7110			

E. Hardware, including locking type nuts, bolts, and set screws: Corrosion resistant, grade 5 steel, especially designed for the intended use.

F. Blue Banger Hanger Inserts approved as an optional component for overhead hanger installations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Coordinate with other trades and verify size, shape, and location of concrete housekeeping pads as provided under Division 3.

1. Housekeeping pads are to be 4 inches high and extend out 4 inches on all sides from the unit mounted thereon, or on three sides if unit is located against the wall.

2. Coordinate with other trades and verify proper installation of leveling channel if leveling channel is required by manufacturer's installation instructions.

B. Verify location of framing.

C. Verify location of inserts.

D. Verify proper installation of inserts in concrete.

3.02 INSTALLATION OF SUPPORT SYSTEMS

A. Install diagonal bracing for trapeze support systems in two perpendicular planes to brace against.

1. Lateral and transverse movement because of earthquake forces.

2. Lateral distortions in the raceway system because of wire pulling.

B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete or approved beam clamps. Do not use spring steel clips and clamps.

C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor or concrete surfaces.

D. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

E. Do not use powder-actuated anchors.

F. Do not drill structural steel members.

G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hex head bolts with spring lock washers under nuts.

H. Free standing electrical equipment:

1. Bolt to floor or housekeeping pad according to manufacturer's recommendation, four bolts minimum.

2. Provide and bolt unit substations to leveling channel as recommended by manufacturer.

3. Brace and bolt motor control centers, at the top to prevent overturning in the event of an earthquake.

I. Install surface-mounted cabinets and panelboards with at least four anchors to 14 gauge formed steel channel supports to stand cabinet minimum 3/4-inch off wall.

1. Attach channel to wall studs with four 3/8-inch toggle bolts where panels and/or cabinets are shown on GWB walls.

2. Attach channel to wall with four expansion bolts where panels and/or cabinets are shown on masonry walls.

J. Bridge studs at top and bottom of recessed cabinets and panelboards in stud walls with bridging made for the purpose.

K. Transformer support:

1. Bolt to housekeeping pad using four 1/2-inch diameter bolts where shown floor mounted. See 1.04.B.

2. Where shown as column mounted, bolt to a steel shelf welded to structural column by a certified welder. See 1.04.B.

L. Lighting fixture support:

1. Lay-in fixtures: Support independently of ceiling grid using two T-bar clips and/or two #12 galvanized steel wires with slack at diagonal corners.

2. Pendant type fixtures: Support independently as shown on Drawings. Provide earthquake sway restraint(s) to restrain fixture from hitting adjacent objects. Independent support may be used as (one of) the earthquake sway restraint(s). See 1.04.B.

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL 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.

1.02 SUMMARY

A. This section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring

B. Related Sections:

1. Section 26 05 43 – Underground Ducts, Raceways and Manholes
2. Section 26 05 29 – Hangers and Supports for Electrical Systems

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. NBR: Acrylonitrile-butadiene rubber.

H. RGSC: Rigid galvanized steel conduit.

I. RNC: Rigid nonmetallic conduit.

J. RSC: Rigid steel conduit.

1.04 SUBMITTALS

A. Shop Drawings

1. Include plans, elevations, sections, details, and attachments to other work for the following raceway components:
    a. Custom enclosures
    b. Cabinets.

B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.

2. Coating Thickness: 0.040 inch minimum.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.

2. Fittings for EMT: Steel, compression type.

3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch with overlapping sleeves protecting threaded joints.

G. Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

B. LFNC: UL 1660.

C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

D. Fittings for LFNC: UL 514B.

2.03 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Description: Comply with UL 2024; flexible type, approved for general-use installation.

2.04 METAL WIREWAYS

A. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, and 3R, unless otherwise indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Hinged type and flanged-and-gasketed type in wet areas.

D. Finish: Manufacturer's standard enamel finish.

2.05 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: FRP.

G. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

H. Floor Boxes:

1. Recessed 2 gang Hubbell CFB2G25 series with hinged door cover.
2. Recessed 4-gang Hubbell CFB4G25 series with hinged door cover.

2.06 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray, ANSI 61.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.07 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section 07 90 00 – Joint Protection, thickness as indicated and of length to suit application.

2.08 SLEEVE SEALS

A. Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.09 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit.

2. Concealed Conduit, Above ground: Rigid steel conduit.

3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.

6. Application of Handholes and Boxes for Underground Wiring:

a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.

b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Non-Deliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.

c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested per SCTE 77 with 3000-lbf

B. Comply with the following indoor applications, unless otherwise indicated:

1. All conduits 2 inches diameter and larger shall be RGSC type.

2. All conduits carrying medium voltage conductors (4,160V or above) shall be RGSC.

3. All conduits carrying feeder conductors shall be RGSC type.

4. Exposed, 48” AFF and Below: RGSC.

5. Exposed, Not Subject to Physical Damage Above 48” AFF: EMT.

6. Exposed, Not Subject to Severe Physical Damage Above 48: AFF: EMT.

7. Exposed and Subject to Severe Physical Damage: RGSC. Includes raceways in the following locations:

a. Loading dock.

b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

c. Mechanical rooms.

8. Concealed in Ceilings and Interior Walls and Partitions: EMT.

9. Connection to Vibrating Equipment (Including Transformers and Hydraulic,

10. Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

11. Damp or Wet Locations: Rigid steel conduit.

12. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.

13. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.

14. Raceways for Concealed General Purpose Distribution of Optical Fiber or communications Cable: General-use, optical fiber/communications cable raceway.

15. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

16. Underslab conduit installation:

a. Galvanized Rigid Steel Conduit. Coat with 2 coats of bitumastic or protect with 3M Scotchrap Pipe Primer and Scotchrap 50 (10 mil) spirally applied half-lapped tape.

b. Bury minimum of 6 inches below bottom of slap.

c. Top of conduits shall have threaded coupling flush with finished floor.

17. Raceways in manholes carrying low voltage wiring (alarming cable, 120V and 480V) shall be routed in Sch. 80 PVC.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot - water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section 26 05 29 "Hangers and Supports for Electrical Systems".

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Do not embed raceways in slabs.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than #4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

   1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet

   2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet

   3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

   2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of above ground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet

   1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F

      b. Outdoor Locations Exposed to Direct Sunlight: temperature change. 155 deg F

      c. Indoor Spaces: Connected with the Outdoors without Physical Separation: temperature change. 125 deg F

   2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches for light fixtures and 18" for other connections.

1. Use LFMC in damp or wet locations subject to severe physical damage of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

S. Provide approved conduit expansion fittings at building expansion joints.

T. Metallic conduit stub-ups shall be terminated with a bushing lined with non-metallic insert to protect wiring at the point where it exits conduit. Stub-ups below panels, switchgear, etc. shall have similar lined bushing with grounding attachment. Bond conduit to panel ground bus by addition of external jumper wire.

3.03 INSTALLATION OF MINOR UNDERGROUND CONDUIT

A. For major underground conduit installation, greater than 50 feet, comply with Section 26 05 43 - "Underground Ducts and Raceways for Electrical Systems"

1. All buried conduit shall be 6" below bottom of slab (if applicable). No conduits shall be encased in floor slabs.

B. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 23 17 - Trenching for pipe less than 6 inches

2. Install backfill as specified in Section 31 23 23 - Earthwork.

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand-tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 23 23 - Earthwork.

4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches

b. All stub-ups to include those that are not in use shall have threaded coupling set flush with floor, and insulated grounding bushings on terminations at equipment.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finish grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

E. Field-cut openings for conduits per enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of Firestopping specified in Division 07 Section 07 90 00 – Joint Protection.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch

2. For sleeve cross-section rectangle perimeter equal to, or greater than 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch seal space.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies. Seal annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Section 07 90 00 - Joint Protection.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section 07 90 00 – Joint Protection.

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.06 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Sections 07 90 00 – Joint Protection.

3.08 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touch up coating as recommended by manufacturer.

END OF SECTION

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks.
2. Handholes and boxes.
3. Manholes.

B. This section applies to power and communications systems.

1.03 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including reinforcing materials, separators and miscellaneous components.

2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.

3. Accessories for manholes, handholes, pull boxes, and other utility structures.

4. Warning tape.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.

2. Reinforcement details.

3. Frame and cover design and manhole frame support rings.

4. Ladder.

5. Grounding details.

6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

7. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.

2. Cover design.

3. Grounding details.

4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

5. Ladder cover details.

D. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

E. Product Certificates: For concrete and steel used in precast concrete manholes, handholes, and pull boxes as required by ASTM C 858.

F. Qualification Data: For professional engineer and testing agency.

G. Source quality-control test reports.

H. Field quality-control test reports.

I. All covers shall be traffic rated for heavy trucks.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.07 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager no fewer than five days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

1.08 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by the Engineer.

1.09 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.

B. Furnish cable-support stanchions, arms, insulators and associated fasteners and accessories in quantities equal to 5 percent of quantity of each item installed.

PART 2 - PRODUCTS

2.01 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2 Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

C. Liquid-tight flexible metallic conduit.

2.02 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other equal manufacturers.

1. Cantex, Inc.

2. CertainTeed Corp.; Pipe & Plastics Group.

3. Condux International, Inc.

4. ElecSys, Inc.

5. Electri-Flex Company.

6. IPEX Inc.

7. Lamson & Sessions; Carlon Electrical Products.

8. Manhattan/CDT; a division of Cable Design Technologies.

9. Spiraduct/AFC Cable Systems, Inc.

B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.

2. Warning Tape: Underground-line warning tape specified in Division 16 Section “Electrical Identification” for power and communications systems.

2.03 PRECAST CONCRETE HANDHOLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other equal manufacturer.

1. Utility Vault Company

2. Oldcastle Precast Group.

3. Riverton Concrete Products; a division of Cretex Companies, Inc.

4. Utility Concrete Products, LLC.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A153 and ASTM A123.

D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

3. Cover Legend: Molded lettering, “ELECTRICAL” or “COMMUNICATIONS.”

4. Install sign on cover identifying “CONFINED SPACE HAZARD.”

5. Configuration: Units shall be designed for flush burial and have closed bottom.

6. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

7. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

a. Type and size shall match fittings to duct or conduit to be terminated.

b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

8. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.04 PRECAST MANHOLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other equal manufacturer.

1. Utility Vault Company

2. Oldcastle Precast Group.

3. Riverton Concrete Products; a division of Cretex Companies, Inc.

4. Utility Concrete Products, LLC.

B. Comply with ASTM C 858, with structural design loading as specified in Part 3 "Underground Enclosure Application" Article and with interlocking mating sections, complete with accessories, hardware, and features.

1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.

b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

a. Type and size shall match fittings to duct or conduit to be terminated.

b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

3. Manhole Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and locking provisions.

4. Cover Legend: Molded lettering, “ELECTRICAL” or “COMMUNICATIONS.”

5. Install sign on cover identifying “CONFINED SPACE HAZARD.”

C. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.

D. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the

installation location with the ground-water level at grade.

2.05 PULL BOXES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Armorcast Products Company.

2. Carson Industries LLC.

3. CDR Systems Corporation.

4. Hubbell Power Systems; Lenoir City Division.

5. New Basis.

B. Description: Comply with SCTE 77.

1. Color: Gray.

2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering, "ELECTRIC" or “COMMUNICATIONS.”

6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

C. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.06 UTILITY STRUCTURE 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:

1. Bilco Company

2. Hubbell Power Systems.

3. McKinley Iron Works, Inc.

4. NewBasis.

5. Oldcastle Precast Group.

6. Riverton Concrete Products; a division of Cretex Companies, Inc.

7. Strongwell Corporation; Lenoir City Division.

8. Underground Devices, Inc.

9. Utility Concrete Products, LLC.

10. Utility Vault Co.

B. Ferrous metal hardware, where indicated, shall be hot-dip galvanized complying with ASTM A 153 and ASTM A 123.

C. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29 inches

a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

2. Cover Legend: Cast in. Selected to suit system.

a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.

b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.

c. Legend: "COMMUNICATIONS" for communications, data, and telephone duct systems.

3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.

a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.

D. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

E. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inchdiameter eye, and 1-by-4-inch bolt.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

F. Pulling Eyes in Non-concrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch diameter eye, rated 2500-lbf Minimum tension.

G. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch-diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

H. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steelwedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

J. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.

2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.

3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

K. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment.

2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.

L. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

M. Portable Manhole Ladders: UL-listed, heavy-duty fiberglass specifically designed for portable use for access to electrical manholes. Minimum length equal to distance from deepest manhole floor to grade plus 36 inches. Three required.

N. Cover Hooks: Heavy duty, designed for lifts
60 lbf and greater Six required.

2.07 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Non-concrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency engaged by the county.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. Type tests for similar products shall be acceptable. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.01 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables over 600 V: RNC, NEMA Type EPC-40-PVC, in reinforced concrete-encased duct bank, unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC**,** NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

D. Underground Ducts for Telephone, Communications, or Data Cables: RNC, NEMA Type EPC-40-PVC, in reinforced concrete-encased duct bank, unless otherwise indicated.

E. Underground Ducts Crossing Roadways: RNC, NEMA Type PC-40-PVC, installed by jack and bore process.

3.02 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Pullboxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Roadways, parking lots and other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.

2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20, polymer concrete, SCTE77, tier 15 structural load rating.

3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10, polymer concrete units, SCTE77, tier 8 structural load rating.

4. Units in areas which may become future taxiway, aircraft rating per civil engineering specifications.

B. Manholes: Precast concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.

2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.03 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earthmoving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

D. Do not cut existing pavement in the path of underground ducts and utility structures. Jack and bore under existing roadways and driveways as indicated.

3.04 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes

and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 25 feet , both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 8 inches o.c. for 4-inch ducts, 10 inches o.c. for 5-inch ducts and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.

2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition.

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written

recommendations, or use other specific measures to prevent expansion contraction damage.

b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

3. Concrete Color: Red dye added to concrete during batching for MV duct bank.

4. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power driven agitating equipment unless specifically designed for duct-bank application.

5. Reinforcement: Reinforce concrete-encased duct banks. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

6. Forms: Use walls of trench to form side walls of duct bank where soil is self supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

7. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.

8. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.

9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.

b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

10. Warning Tape: Bury warning tape approximately 12 inches above all concrete encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 20 inches. Space additional tapes 12 inches apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.

3. Excavate trench bottom to provide firm and uniform support for duct bank.

4. Install backfill as specified in Division 31, “Earthmoving.”

5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction.

6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and communications ducts.

7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.

8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.

    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.05 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND PULL BOXES

A. Precast Concrete Handhole, Manhole, and Pull Box Installation:

1. Comply with ASTM C 891, unless otherwise indicated.

2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.

2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.

3. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.

4. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains and sump pumps in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

E. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms and insulators as required for installation and support of cables and conductors and as indicated.

G. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

H. Warning Sign: Install "CONFINED SPACE HAZARD" warning sign spot welded to the top surface of each manhole cover.

3.06 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section “Grounding and Bonding for Electrical Systems.”

3.07 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of

installation of underground ducts and utility structures.

2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 05 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.08 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include Division 26 Section "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.03 DEFINITIONS

A. The IBC: International Building Code, currently adopted Edition.

1.04 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer Seismic Qualification Certification: Submit certification that switchgear will withstand seismic forces as described in the IBC and ASCE-7-10 for local (Seattle, WA) conditions. Include the following:
   a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      (1) The term "withstand" means the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.
   b. Dimensioned Outline Drawings of Equipment Units: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
   b. Include rated load, rated deflection, and overload capacity for each vibration isolation device
   c. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
   a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.

3. Field-fabricated supports.

4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by an agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATORS

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. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene or rubber.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed eight of the spring at rated load.

2. Minimum Additional Travel: 50 percent of the required deflection at rated load.

3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig

6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

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D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation

2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.

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3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.02 SEISMIC-RESTRAINT DEVICES

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. Amber/Booth Company, Inc.

2. California Dynamics Corporation.

3. Cooper B-Line, Inc.

4. Hilti Inc.

5. Mason Industries.

6. TOLCO Incorporated; a brand of NIBCO INC.

7. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.03 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.

3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been orrected.

3.02 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.

2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and elecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, able trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. Verify snubber minimum clearances.

9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 48 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

B. Related Sections include Division 26 Section "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.03 DEFINITIONS

A. The IBC: International Building Code, currently adopted Edition.

1.04 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer Seismic Qualification Certification: Submit certification that switchgear will withstand seismic forces as described in the IBC and ASCE-7-10 for local (Seattle, WA) conditions. Include the following:
   a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      (1) The term "withstand" means the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.
   b. Dimensioned Outline Drawings of Equipment Units: Identify center of gravity and locate and describe mounting and anchorage provisions.
   c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
   b. Include rated load, rated deflection, and overload capacity for each vibration isolation device
   c. Annotate to indicate application of each product submitted and compliance with requirements.

3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
   a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.

3. Field-fabricated supports.

4. Seismic-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Field quality-control test reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by an agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATORS

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. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene or rubber.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed eight of the spring at rated load.

2. Minimum Additional Travel: 50 percent of the required deflection at rated load.

3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig

6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

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D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation

2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.

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3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.02 SEISMIC-RESTRAINT DEVICES

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. Amber/Booth Company, Inc.

2. California Dynamics Corporation.

3. Cooper B-Line, Inc.

4. Hilti Inc.

5. Mason Industries.

6. TOLCO Incorporated; a brand of NIBCO INC.

7. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.03 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.

2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.

3. Baked enamel or powder coat for metal components on isolators for interior use.

4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been orrected.

3.02 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators on electrical equipment.

2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and elecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, able trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. Verify snubber minimum clearances.

9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.06 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates and tape labels.

B. Wire and cable markers.

C. Conduit color coding.

1.02 RELATED SECTIONS

A. Section 09 91 00 - Painting

1.03 SUBMITTALS

A. Submit Shop Drawings under provisions of Section 01 33 00 – Submittals, including schedule for nameplates and tape labels.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.

B. Tape labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

C. Wire and cable markers: Cloth markers, split sleeve or tubing type.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Degrease and clean surfaces to receive nameplates and tape labels.

B. Install nameplates and tape labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws or rivets. Adhesives are not acceptable. Secure nameplate to inside face of recessed panelboard doors in finished locations.

D. Use embossed tape only for identification of individual wall switches and receptacles, and control device stations.

3.02 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's Shop Drawings for control wiring.

B. Wire color coding:

1. Color code wiring as indicated below:

SYSTEM	CONDUCTORS			
	A	B	C	Neutral/COM
208Y/120 Volts	Black	Red	Blue	White

480Y/277 Volts	Brown	Orange	Yellow	Gray
120 Volts Control	Red	-	-	White
120 Volts UPS Power	Orange	-	-	WHT/ORG
External Power Source	Yellow	-	-	Yellow
DC Power/Control	Blue	-	-	WHT/BLU

2. Insulated ground conductors: Green.

3. Isolated ground conductors: Green with a yellow trace.

C. If large conductors cannot be purchased with the correct insulation color, color code the conductors with wire and cable markers of the appropriate color. Completely encircle the conductor with color coding for a minimum length of 6 inches.

3.03 NAMEPLATE ENGRAVING SCHEDULE

A. Provide 2 inch high by 6 inch wide nameplates to identify the following electrical distribution and control equipment:

1. Panelboards

2. Control panels

3. Lighting control panels

4. Motor control centers

B. Provide 3/4 inch high by 3 inch wide nameplates to identify the following electrical distribution and control equipment:

1. Disconnect switches

2. Control stations

3. 480V receptacles.

C. Labels (embossed tape) are unacceptable except for interior 120v receptacles and 120V & 277V light switches.

D. Secure nameplates to equipment using screws or wire loop. Adhesives are unacceptable.

E. Nameplates and labels shall indicate panel and circuit number equipment is served from (e.g. “206A5E/2a” for circuit 2a from panel 206A5E). For items included in 3.03.A above, include name, voltage, number of phases, and number of wires in addition to panel and circuit number equipment is served from. See Figure 1.

F. All devices installed or revised under this contract shall be provided with nameplates. This includes all devices not physically relocated but recircuited.

G. Nameplates shall be engraved black text on a white background. See example in figure 1 for details.

3.04 RECEPTACLE IDENTIFICATION

A. Provide tape labels on receptacle cover plates. Indicate panel and circuit breaker number feeding device.

B. Provide additional label on all controlled circuits as indicated by the drawings. Label must clearly identify the receptacle as “CONTROLLED RECEPTACLE”.

3.05 CONDUIT COLOR CODING

A. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

B. Primary distribution system: 12.47 kV - See Sections 26 05 33 and 26 05 13.

NOTE: LETTERING ON FIRST LINE IS 1/2" HIGH. ALL OTHER LINES OF LETTERING ARE 1/4" HIGH WITH 1/4" SPACING BETWEEN ALL LINES.

TYPICAL NAMEPLATE
NOT TO SCALE

FIGURE 1

END OF SECTION

SECTION 26 00 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes commissioning process requirements for Electrical, Lighting, Voice, Data, Security, and Fire Alarm systems, assemblies, and equipment.

B. Related Sections:

1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 REFERENCES

A. ANSI/NETA ATS (International Electrical Testing Association, Inc.) Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. FPA 70 (National Fire Protection Association) National Electrical Code.

C. NFPA 70E (National Fire Protection Association) Standard for Electrical Safety in the Workplace.

D. NFPA 110 (National Fire Protection Association) Standard for Emergency and Standby Power Systems.

E. WSEC Chapter 51-11 WAC (Washington State Energy Code) Standard for efficient use and conservation of energy.

F. USGBC (U.S. Green Building Council) Sustainable building and development practices through LEED (Leadership in Energy and Environmental Design) certification system.

1.4 DEFINITIONS

A. Acceptable Performance: A component or system being able to meet specified design parameters under actual load.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CA: Commissioning Authority.

D. ETO: Electrical Test Organization

E. Field Commissioning Notebook: The General Contractor will maintain the commissioning documentation in the “VELA System”.

F. Functional Performance Testing: Full range of checks and tests carried out to determine if all components, sub-systems, systems, and interfaces between systems function in accordance with the Contract Documents. In this context “function” includes all modes and sequences of control operation, all interlocks and conditional control responses, and all specified responses to abnormal emergency conditions.

G. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

H. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Collect and assemble the Subcontractor and/or supplier information required for development of a complete Commissioning Plan and Functional Performance Test for all systems to be commissioned by the Commissioning Authority for inclusion into the commissioning report. The Contractor and appropriate Subcontractors shall review these documents. Confirm in writing to the Owner, Architect, and Commissioning Authority any known areas of conflict or areas requiring clarification.

B. Collect all proposed start-up and pre-functional checklist documentation from appropriate Subcontractors, third party electrical testing agencies (ETO), and equipment vendors. Provide that information to the Commissioning Authority for inclusion into the commissioning report. Incorporate that information into the VELA System.

C. Provide commissioning documentation into VELA System, managed by the Contractor. The Contractor shall confirm in writing to the Commissioning Authority that systems are complete, functional, and the appropriate Subcontractors have signed off all pre functional performance documentation

D. Perform commissioning tests in coordination with the CA and the Commissioning plan.

E. Participate in regular commissioning meetings with the Architect and Commissioning Authority. Coordinate directly with each Subcontractor on their specific responsibilities and contractual obligation

F. Attend construction phase controls coordination meeting(s).

G. Attend testing, adjusting, and balancing review and coordination meeting(s).

H. Participate in fire alarm and lighting control systems commissioning by the CA. Provide third party ETO(s) for testing of the generators, electrical systems and

assemblies, equipment, and component maintenance orientation and inspection in coordination with the CA.

I. Provide information requested by the CA for final commissioning documentation.

J. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

K. Provide the following information to the CA for inclusion in the commissioning documentation:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.

2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for systems, assemblies, equipment, and components to be verified and tested.

4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.

5. Certificate of readiness certifying that systems, subsystems, equipment, and associated controls are ready for testing.

6. Test and inspection reports and certificates.

7. Corrective action documents.

8. Verification of testing, adjusting, and balancing reports.

L. COMMISSIONING DOCUMENTATION

1. Provide the following information to the CA for inclusion in the commissioning plan:

a. Plan for delivery and review of submittals, systems manuals, and other documents and reports.

b. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

c. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for systems, assemblies, equipment, and components to be verified and tested.

d. Certificate of completion certifying that installation checks, and startup procedures have been completed.

e. Certificate of readiness certifying that systems, subsystems, equipment, and associated controls are ready for testing.

f. Test and inspection reports and certificates.

g. Corrective action documents.

h. Verification of testing, adjusting, and balancing reports.

1.6 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. Provide Project-specific pre functional checklists and commissioning process functional performance test procedures for actual systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Develop the Commissioning Plan for the commissioning of the Fire Alarm and Lighting control systems.

C. Develop commissioning pre functional checklist with appropriate documentation provided from Contractor for inclusion into the VELA system.

D. Develop Functional Test Procedures from final control documentation including narrative sequences of operation, control diagrams, and software code for execution with the assistance of Contractor staff as required.

E. Direct and perform functional performance tests with assistance from Subcontractors as required

F. Witness and verify satisfactory completion of equipment and component tests and systems and inter- systems performance tests.

G. Participate in the development of schedules with the Contractor for start-up and functional performance testing. This is to be coordinated with required building purge or Owner occupancy schedules required by the Owner.

H. Review reports and witness and direct the testing verification effort.

I. When commissioning has been successfully completed, recommend acceptance to the Owner.

J. Once all functional performance tests have been successfully completed and all outstanding issues resolved, the Commissioning Authority will provide the Owner with a final report of all commissioning activities that occurred during the project.

K. The Commissioning Authority will formally communicate with the Contractor via approved project channels. It is expected, however, that informal communication and

coordination will be conducted directly with the Subcontractors. Records of all contacts will be sent to the Architect through the normal channels

L. The Commissioning Authority is not authorized to modify, add to, or revoke the requirements of the Contract Document. A change in the Work can only be made as provided in the General Conditions

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. The contractor shall

1. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

2. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

3. Certify that testing and adjusting procedures have been completed and that testing and adjusting, reports have been submitted, discrepancies corrected, and corrective work approved.

4. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

5. Inspect and verify the position of each device and interlock identified on checklists.

6. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

7. Testing Instrumentation: Install measuring instruments and logging devices to record test data in coordination with the CA.

3.2 TESTING VERIFICATION

A. Prior to performance of testing Work, provide copies of reports, sample forms, checklists, and certificates to the GC/CA for inclusion into the VELA system.

B. Provide technicians, instrumentation, and tools to verify testing of electrical systems in coordination with the CA.

1. The Subcontractor (ETO) will notify the CA 14 days in advance of the date of field verification. Notice will not include data points to be verified.

2. The testing Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.

3. Failure of an item includes any construction or manufacturing defect that renders the electrical system or subsystem unable to provide its intended function. Failure shall result in rejection of the final testing report.

4. Remedy the deficiency and notify the CA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test in coordination with the CA.

B. Scope of electrical commissioning tests shall include the functional testing of the entire electrical installation beginning at the utility interface and ending at the utilization equipment including, but not limited to:

1. Generators.

2. Switchgear.

3. Switchboards.

4. Transformers.

5. Conductors.

6. Panelboards.

7. Protective relays.

8. Control relays.

9. Programmable logic controllers.

10. Human machine interfaces.

11. Circuit breakers.

12. Bussing.

C. Scope of lighting system testing shall include the entire lighting system of automatic and manual controls including, but not limited to:

1. Occupancy sensors.

2. Timed lighting controls.

3. Day-lighting controls.

4. Dimmers.

5. Scene controls.

6. Exterior light sensors.

7. Obstructions and light pollution controls.

8. Lighting system control interlocks, meters, and contacts.

D. Testing of fire alarm systems shall include the entire fire alarm system from each initiating device through the fire alarm control and annunciation panels to the master fire alarm station including, but not limited to:

1. Smoke detectors.

2. Duct smoke detectors.

3. Heat detectors.

4. Manual initiating devices including pull stations.

5. Notification strobes.

6. Notification horns and alarms.

7. System failure alarms and notifications.

8. Spare circuits in control panel.

9. Battery.

10. Charger.

11. Wiring.

E. Testing of voice and data systems shall include the entire system from the site master operating station to each utilization device including, but not limited to:

1. Data outlets.

2. Voice outlets.

3. Patch panels.

4. Cross connects.

5. Uninterruptible Power Supplies.

6. Wiring.

F. Testing of security systems shall include the entire system from the on/off-site security monitoring station to each detection and monitoring device including, but not limited to:

1. Cameras.

2. Keyed and keypad entry locks.

3. Tamper detectors.

4. Intrusion detectors.

5. Motion sensors.

6. Monitors.

7. System failure monitors and notification.

8. Uninterruptible Power Supplies.

9. Wiring.

G. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

H. The CA along with the Contractor, Electrical Subcontractor, Lighting Subcontractor, Voice and Data Subcontractor, Security Subcontractor, and Fire Alarm Subcontractor, shall prepare detailed testing plans, procedures, and checklists for electrical; lighting; voice and data; security; and fire alarm systems, subsystems, and equipment.

I. Tests will be performed using design conditions whenever possible.

J. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

K. The CA may direct that set points be altered when simulating conditions is not practical.

L. The CA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

M. If tests cannot be completed because of a deficiency outside the scope of the system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

N. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 ELECTRICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Electrical Generation, Transmission, Distribution, and Utilization System Testing: Field testing plans and testing requirements in accordance with ANSI/NETA ATS and as specified in Divisions 26 and 33.

B. Lighting and Lighting Control System Testing: Field testing plans and testing requirements are specified in Division 26. Assist the CA with preparation of testing plans.

C. Fire Alarm System Testing: Field testing plans and testing requirements are specified in Divisions 26 and 28. Assist the CA with preparation of testing plans.

D. Security System Testing: Field testing plans and testing requirements are specified in Divisions 26 and 28. Provide to the CA testing plans.

E. Voice and Data Systems Testing: Field testing plans and testing requirements are specified in Divisions 26 and 27. Provide to the CA testing plans.

3.5 COMMISSIONING COMPLETION

A. Upon Contractor’s completion of the requirements of the commissioning plan and the successful completion of the Performance period, and receipt of the require documentation, the Architect will provide the Owner with a statement of acceptable performance. Receipt of the acceptable performance statement by the Owner shall be a condition of final completion of the project.

END OF SECTION

SECTION 26 08 01 - ELECTRICAL TESTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical Acceptance Testing

1.02 RELATED SECTIONS

A. Section 26 08 00, “Electrical Systems Commissioning”

1.03 INSPECTION AND TESTING

A. Short circuit and coordination studies provided by others.

B. Testing firm will provide material, equipment, labor, and technical supervision to perform such tests and inspections.

C. Tests are to ensure that electrical equipment is operational and within industry and manufacturer's tolerances, is installed in accordance with specifications, and to determine suitability for energization.

1.04 REFERENCED STANDARDS

A. American National Standards Institute: ANSI

1.	ANSI C2	National Electrical Safety Code
2.	ANSI Z244-1	American National Standard for Personnel Protection

B. National Fire Protection Association: NFPA

1.	NFPA 70	National Electrical Code
2.	NFPA 70B	Electrical Equipment Maintenance
3.	NFPA 70E	Electrical Safety Requirements for Employee Workplaces
4.	NFPA 78	Lightning Protection Code
5.	NFPA 101	Life Safety Code

C. National Electrical Code (NEC)

D. Occupational Safety and Health Administration: OSHA

1.	OSHA Part 1910	Subpart S, 1910.308
2.	OSHA Part 1926	Subpart V, 1926.950 through 1926.960

E. State and local codes and ordinances

1.05 SUBMITTALS

A. Test reports: Summary of Project, description of equipment tested, description of test, test results, conclusions and recommendations, appendix, including appropriate test forms, identification of test equipment used, and signature of responsible test organization authority. Submit 5 copies of the complete report to the Project Electrical Engineer no later than 30 days after completion of Project, unless directed otherwise.

B. Certification of qualifications of testing firm.

C. Calibration program for test instrumentation indicating maintenance of rated accuracy.

D. Submit the manufacturer's installation manual & equipment specific proposed startup documents as a part of the initial equipment submittal.

1.06 QUALITY ASSURANCE

A. Qualifications of testing agency:

1. Corporately independent testing organization which can function as an unbiased testing authority professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.

2. Regularly engaged in the testing of electrical equipment devices, installations, and systems.

3. Engaged in such practices for a minimum of 5 years.

4. Meet Federal OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910, and 1936.

5. Provide lead technical person on site currently certified by the International Electrical Testing Association (NETA) or have at least 5 years of experience in electrical power distribution system testing.

6. Utilize only full-time technicians who are regularly employed by the firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance. Electricians and linemen may assist, but may not perform testing and inspection services.

7. Submit proof of the above qualifications with bid documents when requested.

1.07 CONTRACTOR RESPONSIBILITY

A. Perform insulation resistance, continuity, and rotation tests for distribution and utilization equipment before, and in addition to, tests performed by the testing firm.

B. Supply source of electrical power to each test site as specified by testing firm.

C. Notify the testing firm when equipment becomes available for Acceptance tests. Coordinate to expedite Project scheduling.

1.08 ENGINEER RESPONSIBILITY

A. Short circuit and coordination studies provided by others.

1.09 TESTING FIRM RESPONSIBILITY

A. Notify the engineer before commencement of testing.

B. Report systems materials or workmanship which is found defective on the basis of Acceptance tests.

C. Maintain written record of tests and upon completion of Project, assemble and certify a final test report.

1.10 LIMITATION OF AUTHORITY OF TESTING FIRM

A. Testing firm is not authorized to—

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or Accept any portion of the work.
3. Perform duties of Contractor.
4. Stop the work.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. Calibration:

1. Testing firm to have a calibration program which ensures that applicable test instrumentation are maintained within rated accuracy.
2. Accuracy to be directly traceable to the National Bureau of Standards.
3. Calibrate instruments in accordance with the following frequency schedule:
   a. Field instruments: Analog - 6 months maximum
      Digital - 12 months maximum
   b. Laboratory instruments: 12 months.
   c. Leased specialty equipment: 12 months. (Where accuracy is guaranteed by lessor.)
4. Provide visible, dated calibration labels on test equipment.
5. Keep records up-to-date showing date and results of instruments calibrated or tested.
6. Maintain up-to-date instrument calibration instruction and procedure for each test instrument.
7. Calibrate using standard of higher accuracy than that of the instrument tested.

PART 3 - EXECUTION

3.01 SAFETY AND PRECAUTIONS

A. Use safety practices conforming to the following requirements:

1. Occupational Safety and Health Act of 1970 - OSHA.
2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.
3. Applicable state and local safety operating procedures.
4. Owner's safety practices.
5. National Fire Protection Association - NFPA 70E.
6. ANSI Z244.1, American National Standards for Personnel Protection

B. Perform tests with apparatus de-energized except where otherwise specifically required and stated in equipment sections.

C. The testing firm will provide designated safety representative on the Project to supervise operations with respect to safety.

D. Utilize the following references for inspections and tests:

1. Project design specifications.
2. Project Design Drawings.
3. Project short circuit and coordination study.
4. Manufacturer's instruction manuals applicable to each particular apparatus.

3.02 COMMISSIONING

A. Contractor and Equipment Manufacturer’s Participation in Project Commissioning

1. Assist in developing the final functional test procedures as specified in Sections 26 08 00 and related sections.
2. Provide building commissioning support as specified in Sections 01 70 00, 26 08 00 and related sections.

B. Tests Required:

1. See Section 26 08 00 – Electrical Systems Commissioning

END OF SECTION

SECTION 26 09 43 - LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Distributed Digital Lighting Control System: System includes

1. Digital Lighting

1.02 REFERENCES

A. NFPA 70 - National Electrical Code; National Fire Protection Association.

B. NEMA - National Electrical Manufacturers Association

C. UL - Underwriters Laboratories, Inc. Listings

D. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.

E. UL 20 - General Use Switches, Plug Load Controls

F. UL 924 - Standard for Emergency Lighting and Power Equipment

1.03 DESIGN / PERFORMANCE REQUIREMENTS

A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing power packs and switches.

B. System shall conform to requirements of NFPA 70.

C. System shall be listed under UL sections 916 and/or 508.

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Catalog sheets and specifications.
2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
3. Storage and handling requirements and recommendations.
4. Installation instructions.

B. Shop Drawings: Wiring diagrams for the various components of the System specified including:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
2. Show location of all devices, including at minimum power packs and switches for each area on reflected ceiling plans.
3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.

C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

D. Closeout Submittals:

1. Project Record Documents: Record actual installed locations and settings for lighting control devices.

2. Operation and Maintenance Manual:

a. Include approved Shop Drawings and Product Data.

b. Include Sequence of Operation, identifying operation for each room or space.

c. Include manufacturer's maintenance information.

d. Operation and Maintenance Data: Include detailed information on device programming and setup.

e. Include startup and test reports.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.

B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.

C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.06 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.

B. Review installation procedures and coordination required with related Work and the following:

1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.

2. Review the specifications for low voltage control wiring and termination.

3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

4. Discuss requirements for integration with other trades

C. Inspect and make notes of job conditions prior to installation:

1. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.

2. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).

2. Relative humidity: Maximum 90 percent, non-condensing.

1.09 WARRANTY

A. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: WattStopper, which is located at: 2700 Zanker Rd., Suite 168; San Jose, CA 95134; Tel: 408.988.5331; Fax: 408.988.5373; Email: request info (); Web:www.wattstopper.com

B. Substitutions: Not permitted.

2.02 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE CONTROLLERS)

A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

2. Simple replacement using the default automatic configuration capabilities, a power pack may be replaced with an off-the-shelf device.

3. Device Status LEDs to indicate:

a. Data transmission

b. Device has power

c. Status for each load

d. Configuration status

4. Quick installation features including:

a. Standard junction box mounting

b. Quick low voltage connections using standard RJ-45 patch cable

5. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:

a. Turn on to 100 percent

b. Turn off

c. Turn on to last level

6. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.

7. UL 2043 plenum rated

8. Manual override and LED indication for each load

9. Zero cross circuitry for each load

10. All digital parameter data programmed into an individual power pack shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

2.03 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1 and 2 button configuration. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

3. Configuration LED on each switch that blinks to indicate data transmission.

4. Load/Scene Status LED on each switch button with the following characteristics:

a. Bi-level LED

b. Bright status level indicates that load or scene is active

5. Programmable control functionality including:

a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority

b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

D. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.

1. Individual button function may be configured to Toggle, On only or Off only.
2. Individual scenes may be locked to prevent unauthorized change.
3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
4. Ramp rate may be adjusted for each dimmer switch.
5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.04 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

B. Additional parameters exposed through this method include but are not limited to:

1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:

1. Device list report: All devices in a project listed by type.
2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.

D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:

1. Set, copy/paste an entire project site of sensor time delays.
2. Set, copy/paste an entire project site of sensor sensitivity settings.
3. Search based on room name and text labels.
4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
5. Filter by parameter value to search for product with specific configurations.

E. Network-wide firmware upgrading remotely via the BACnet/IP network.

1. Mass firmware update of entire rooms.
2. Mass firmware update of specifically selected rooms or areas.
3. Mass firmware upgrade of specific products

F. WattStopper Product Number: LMCS-100, LMCI-100

PART 3 EXECUTION

3.01 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.02 INSTALLATION

A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.

B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.

1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.

2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.

3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.

4. Low voltage wiring topology must comply with manufacturer's specifications.

5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

C. All line voltage connections shall be tagged to indicate circuit and switched legs.

D. Test all devices to ensure proper communication.

E. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

1. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

2. Load Parameters (e.g. blink warning, etc.)

F. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

G. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

H. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

I. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

J. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.

1. Verify Class I and II wiring connections are terminated properly by validating system performance.
2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
4. Verify that the control of each space complies with the Sequence of Operation.
5. Correct any system issues and retest.

C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:

1. Date of test or inspection.
2. Loads per space, or Fixture Address identification.
3. Quantity and Type of each device installed
4. Reports providing each device's settings.

3.04 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Distribution panelboards

B. Lighting and appliance branch-circuit panelboards

1.2 REFERENCES

1.	NFPA 70-1994	National Electrical Code (NEC)
2.	NEMA AB-1	Molded Case Circuit Breakers
3.	NEMA PB-1	Panelboards
4.	NEMA PB-1.1	Instructions for Safe Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or less
5.	NEMA PB-2.2	Application Guide for Ground-fault Protective Devices for Equipment
6.	UL50	Electrical Cabinets and Boxes
7.	UL67	Panelboards
8.	UL489	Molded Case Circuit Breakers

1.3 SUBMITTALS

A. Submit shop drawing, specification sheet, and evidence of UL listing/labeling for each panelboard assembly and each component device. Submit proof of UL testing for each door-in-door design and for door latch/latch-spacing design. Submit proof that each panelboard design has been investigated and found to be adequate to meet the requirements of NEC Article 384, including box wiring space.

B. Include outline dimensions, mounting or support point dimensions, bus capacity, breaker hardware capacity, asymmetrical short circuit interrupting rating, circuit breaker sizes, circuit breaker locking device, circuit breaker arrangement, and short circuit/fault studies (as scheduled).

C. Include detailed panelboard description that correlates to the individual panelboard schedule(s) and specification sheet(s). See paragraph 3.03.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Siemens

B. GE

C. IEM

D. Eaton

2.2 DISTRIBUTION PANELBOARDS

A. Distribution panelboards: NEMA PB-1 and UL67; deadfront-type safety construction.

B. Enclosure: NEMA PB-1 and UL50. NEMA type and mounting as scheduled. Cabinet size to accommodate specified wire bending space. Fabricate using code gage galvanized steel without knockouts. Finish with rust-inhibiting paint. NEMA 12 for Panelboards located in Substation Room.

C. Interiors: Provide interior designed to permit circuit breaker replacement and/or re-configuration without disturbing adjacent units, without removing main bus connectors, and without requiring machining, drilling, or tapping.

D. Wire bending space: NEC Article 384; provide code-required wire bending space. top and bottom wire bending space sized for maximum conductors entering or leaving the enclosure. Provide side wire bending space with full capacity for all circuit breaker positions for maximum conductors terminating in that space; typical for both sides. Also see paragraph 2.02.K for neutral bar clearances.

E. Panelboard cover: UL 50. Provide door-in-door construction with full-length hinges on each door; one door over the deadfront interior (inner door) and one that provides access to the distribution breaker wireways (outer door). For doors with dimension over forty-eight inches, fabricate using minimum 12-gage steel. Doors must open and close with repeated use, and properly latch, without binding or warping. Apply 2 coats of manufacturer's standard light gray finish over a rust-inhibiting primer to exterior and interior surfaces. Finish must pass NEMA standard tests for 3R/12 enclosures.

F. Latches-inner door: Provide metallic, spring-return, flush latches with cylinder-type key locks. Provide multiple latches on doors over thirty inches high; maximum spacing twenty-four inches. Provide common key for multiple latches.

G. Latches-outer door: Provide UL approved, screwdriver operated, metallic link-lock type latches.. Provide single latch with three-point hardware on doors over thirty inches high. Latch spacing as required to meet UL standards for short-circuit testing; twenty-four inches maximum spacing.

H. Circuit directory: Provide permanently mounted circuit directory on the inside surface of the inner door. Fabricate from non-yellowing, break-resistant polycarbonate. Size to accept a 8.5 x 11-inches directory card. Metallic frame is permitted.

I. Nameplates: Provide factory-installed 5 inches wide x 1-inch high laminated plastic nameplate with engraved panel number as scheduled White background with black lettering in 1/2-inch high characters. Permanently mount on front of panel cover directly above the inner door. Adhesive-backed nameplates are not acceptable.

J. Bus ratings: Provide panelboards with main copper bus; rating as scheduled; bus phasing "A", "B", "C" from left to right when facing front of panelboard. Provide main bus and breaker mounting hardware for all positions including scheduled "spaces" for future breakers; suitably insulated and braced for panelboard short circuit rating.

K. Neutral bar: For a 4- or 5-wire voltage system, provide a separate factory-installed copper. UL listed, fully-rated (100%), neutral conductor bar as scheduled. Insulate from the enclosure, and

include suitable lugs for all pole positions and for the incoming neutral conductor(s) as scheduled. Increase wire bending space to maintain code-required clearances.

L. Grounding bar: Provide a UL approved copper equipment grounding bar, bonded to the enclosure as scheduled. Provide suitable lugs for all pole positions and for the incoming grounding conductor(s) as scheduled.

M. Short circuit rating: Provide short circuit interrupting capability to meet or exceed the values determined by the coordination study. Series-rated assemblies are not acceptable.

N. Main circuit breaker: Provide factory-installed molded case circuit breaker as scheduled; bolted in place; location in panelboard as scheduled. Provide cable connecting lugs on line side of breaker and a barrier or line shield to prevent accidental exposure to live parts when the panel cover is removed. Sizes, ratings, options, and accessories as scheduled. Ampere rating must be clearly visible without removing trim. Provide padlockable lockout/tagout handle attachment.

O. Distribution circuit breakers: Provide factory-installed molded case circuit breakers and directed arrangement as scheduled. Ampere rating must be clearly visible without removing trim. Provide padlockable lockout/tagout handle attachment for each circuit breaker. Provide factory-installed, laminated plastic, breaker position identification plates to match panel schedule numbering; white letters on black background; permanently mount on interior trim adjacent to breaker positions.

P. Current limiting molded case circuit breakers: NEMA AB-1 and UL489; provide circuit breakers with integral adjustable thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 35,000 symmetrical amperes; let through current and energy level less than permitted for the same size Class RK-5 fuse. See paragraph 2.02.Q for additional requirements.

Q. Molded case circuit breakers: NEMA AB-1 and UL489; provide bolt-on type circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Where scheduled, provide circuit breakers UL listed and labeled for type HACR service and SWD for switching duty. Provide non-welding silver alloy contacts; arc-extinguishing chutes consisting of metal grid plates mounted on heat-absorbing insulating supports; ground and polished latch surfaces; and quick-make, quick-break operating mechanism with toggle-type handle. All poles open, close, and trip simultaneously. Tripped condition indicated automatically by the operating handle moving to a position half way between the extreme ON and OFF positions.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Lighting and appliance branch circuit panelboards: NEMA PB-1 and UL67; deadfront-type safety construction.

B. Enclosure: NEMA PB-1 and UL50. NEMA type and mounting as scheduled. Cabinet size as scheduled. Fabricate using code gage galvanized steel without knockouts. Finish with rust-inhibiting paint. NEMA 12 for Panelboards located in Substation Room.

C. Interiors: Provide interior designed to permit circuit breaker replacement and/or re-configuration without disturbing adjacent units, without removing main bus connectors, and without requiring machining, drilling, or tapping.

D. Wire Bending Space: NEC Article 384; provide code required wire bending space maximum conductors entering or leaving the enclosure. Provide side wire bending space with full capacity for all circuit breaker positions, including future additions, and sized for maximum conductors terminating in that space; typical for both sides. Also see paragraph 2.03.K for neutral bar clearances.

E. Panelboard Cover: UL 50. Provide door-in-door construction with full-length hinges on each door; one door over the deadfront interior (inner door) and one that provides access to the branch breaker wireways (outer door). Doors must open and close with repeated use, and properly latch, without binding or warping. Apply 2 coats of manufacturer's standard light gray finish over a rust-inhibiting primer to exterior and interior surfaces. Finish must pass NEMA standard tests for 3R/12 enclosures.

F. Latches - Inner Door: Provide UL-approved metallic, spring-return, flush latches with cylinder-type key locks. Provide single latch with three-point hardware on doors over thirty inches high. Latch spacing as required to meet UL standards for short-circuit testing; twenty-four inches maximum spacing. Provide common key for multiple latches.

G. Latches - outer door: Provide UL approved, screwdriver operated, metallic link-lock type latches or 3/4-turn, spring-tension fasteners. Provide multiple latches or single latch with three-point hardware on doors over thirty inches high. Latch spacing as required to meet UL standards for short-circuit testing; twenty-four inches maximum spacing.

H. Circuit directory: Provide permanently mounted circuit directory on the inside surface of the inner door. Fabricate from non-yellowing, break-resistant polycarbonate. Size to accept 8.5 x 11-inch directory card. Metallic frame is permitted.

I. Nameplates: Provide factory-installed 5 inches wide x 1-inch high laminated plastic nameplate with engraved panel number as scheduled. White background with black lettering in 1/2-inch high characters. Permanently mount on front of panel cover directly above the inner door. Adhesive-backed nameplates are not acceptable.

J. Bus ratings: Provide panelboards with main copper bus; rating as scheduled; bus phasing "A", "B", "C" from left to right when facing front of panelboard. Provide main bus and breaker mounting hardware for all positions including scheduled "spaces" for future breakers; suitably insulated and braced for panelboard short circuit rating.

K. Neutral bar: For a 4- or 5-wire voltage system, provide a separate factory-installed copper. UL listed, fully-rated (100%), neutral conductor bar as scheduled. Insulate from the enclosure, and include suitable lugs for all pole positions and for the incoming neutral conductor(s) as scheduled. Increase wire bending space to maintain code-required clearances.

L. Grounding bar: Provide a UL approved copper equipment grounding bar, bonded to the enclosure as scheduled. Provide suitable lugs for all pole positions and for the incoming grounding conductor(s) as scheduled.

M. Short circuit rating: Provide short circuit interrupting capability to meet or exceed the scheduled ratings. Series-rated assemblies are not acceptable.

N. Main circuit breaker: Provide factory-installed molded case circuit breaker as scheduled; bolted in place; location in panelboard as scheduled. Provide cable connecting lugs on line side of

breaker and a barrier or line shield to prevent accidental exposure to live parts when the panel cover is removed. Sizes, ratings, options, and accessories as scheduled. Ampere rating must be clearly visible without removing trim. Provide padlockable lockout/tagout handle attachment.

O. Branch circuit breakers: Provide factory-installed molded case circuit breakers and directed arrangement as scheduled. Ampere rating must be clearly visible without removing trim. Provide padlockable lockout/tagout handle attachment for each circuit breaker. Provide factory-installed, laminated plastic, breaker position identification plates to match panel schedule numbering; white letters on black background; permanently mount on interior trim adjacent to breaker positions.

P. Molded case circuit breakers: NEMA AB-1 and UL489; provide bolt-ontype circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Where scheduled, provide circuit breakers UL listed and labeled for type HACR service and SWD for switching duty. Provide non-welding silver alloy contacts; arc-extinguishing chutes consisting of metal grid plates mounted on heat-absorbing insulating supports; ground and polished latch surfaces; and quick-make, quick-break operating mechanism with toggle-type handle. All poles open, close, and trip simultaneously. Tripped condition indicated automatically by the operating handle moving to a position half way between the extreme ON and OFF positions.

PART 3 EXECUTION

3.1 INSTALLATION

A. Panelboard installation: NEMA PB-1.1; Panelboards shall be installed in the Secondary Distribution Walk-In Enclosure as specified in Section 26 11 16. Provide NEC code clearances and code access requirements for panelboards. Install plumb and level. Install flush with wall finishes (where scheduled to be flush mounting).

B. Height: Unless otherwise scheduled on drawings, Install branch-circuit panelboards and load centers with top of enclosure at six feet above finished floor. Install distribution panelboards so that the center of the operating handle grip (when in its highest position) of the top-most circuit breaker is not greater than 6'-6" above the finished floor.

C. Provide filler plates for all unused spaces in panelboards.

D. Insert EPS panel schedule provided by design engineer for each panelboard. Revise directory to reflect as-built conditions.

3.2 FIELD QUALITY CONTROL

A. Visual and mechanical inspection: Prior to energizing any panelboard, visually inspect for physical damage, proper alignment, anchorage, and grounding; and physically check proper installation and tightness of connections for all circuit breakers. Correct all discrepancies prior to energization and acceptance.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches

B. Receptacles

C. Device plates and box covers

1.2 REFERENCED STANDARDS

1.	FS W-C-596	Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
2.	NEMA WD 1	General-Purpose Wiring Devices.
3.	UL 20	General-Use Snap Switches
4.	UL 498	Attachment Plugs and Receptacles
5.	UL 943	Ground Fault Circuit Interrupters

1.3 SUBMITTALS

A. Submit product data under provisions of Division 1 showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - WALL SWITCHES

A. Hubbell

B. Bryant

C. Arrow-Hart

D. Leviton

E. Pass & Seymour

F. Woodhead

G. Substitutions: Not allowed.

2.2 WALL SWITCHES

A. Wall switches for lighting circuits: UL 20 and NEMA WD 1; AC specification grade, quiet type, snap switch with toggle handle, rated 20 amperes and 277 volts AC. Handle: Plastic, set

vertically; style and color as indicated on the Drawings or as directed by the Construction Manager. Terminals: Screw/clamp type, with side and back access. Poles: Single pole, double pole, 3-way, 4-way, or locking type as indicated on Drawings.

B. Pilot light: Lighted handle made of red polycarbonate plastic with neon pilot lamp; specification grade.

C. Locator: Lighted handle made of red polycarbonate plastic with neon pilot lamp; specification grade.

2.3 ACCEPTABLE MANUFACTURERS - RECEPTACLES

A. Hubbell

B. Bryant

C. Arrow-Hart

D. Leviton

E. Pass & Seymour

F. Woodhead

G. Substitutions: Not Permitted.

2.4 RECEPTACLES

A. Unless otherwise noted comply with the Boeing Facilities Electrical Standard Document D38201-4 (Receptacles and Plugs)

B. GFIC receptacles: UL 943 and NEMA WD 1; duplex convenience receptacle with integral ground fault current interrupter.

2.5 ACCEPTABLE MANUFACTURERS - WALL PLATES

A. Hubbell

B. Bryant

C. Arrow-Hart

D. Leviton

E. Pass & Seymour

F. Substitutions: Under provisions of Division 01.

2.6 WALL PLATES

A. Decorative cover plate: Ivory, smooth plastic, or smooth stainless steel, as indicated on drawings. Stainless steel device plates: #302 satin stainless steel with a minimum thickness of 0.040 inch, and 2-3/4 inches in width for receptacles and switches.

B. Weatherproof cover plate: Gasketed cast metal with hinged gasketed device covers.

C. Attachment screws: Color to match respective device plate.

D. Device plates for exposed installations: By outlet box manufacturer.

E. Emergency power: Stainless steel with engraved identification tags having 1/4-inch-high letters reading EMERGENCY on a single line at the top of the plate, and reading POWER on a single line at the bottom of the plate. See Section 26 05 53.

F. Signal equipment: Bushed or blank plates of the same type and finish as other device plates in the same area.

G. Surface mounted boxes: Sized to fit the box without extending over the sides. Crouse-Hinds #DS23G or approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall switches 48 inches above floor, OFF position down.

B. Install convenience receptacles for cleaning in restrooms at 48”

C. Install convenience receptacles 18 inches above floor, grounding pole on bottom.

D. Install specific-use receptacles at heights shown on the Drawings.

E. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.

F. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

G. Install devices and wall plates flush and level.

H. Identify each device in accordance with Section 26 05 53.

END OF SECTION

SECTION 26 28 13 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Disconnect switches

B. Enclosures

1.02 REFERENCES

A. National Electrical Manufacturer's Association (NEMA)

1. NEMA KS 1 - Enclosed Switches

B. Federal Specifications

1. FS W-S-865 - Switch, Box (Enclosed), Surface Mounted

C. American National Standards Institute (ANSI)

1. ANSI/UL 198C - High-Intensity Capacity Fuses; Current Limiting Types

1.03 SUBMITTALS

A. Submit product data sheets for all switches

PART 2 - PRODUCTS

2.01 DISCONNECT SWITCHES

A. Fusible switch assemblies: NEMA KS 1, FS W-S-865; heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position, with auxiliary contacts. Handle lockable in OFF position. Provide solid neutral and ground bar where indicated. Fuse clips: FS W-F-870.

B. Non-fusible switch assemblies: NEMA KS 1, FS W-S-865; heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position, with auxiliary contacts. Handle lockable in OFF position. Provide solid neutral and ground bar where indicated.

C. Enclosures: NEMA KS 1; per the schedule in 3.02

D. Manufacturer: Square D, Siemens, G.E, Eaton or accepted substitution

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install disconnect switches where indicated on drawings

B. Install fuses in fusible switches

C. Applications where required: disconnect switches shall be provided at:

1. Roof mounted equipment

2. Cooling tower pumps and fans

3. Within sight of all equipment
4. Lifting Means disconnects (Note: must be painted orange)
5. Dry type distribution transformers where remote from source panelboards

3.02 DISCONNECT SWITCH SCHEDULE

A. Type: All disconnect switches to be non-fusible type unless specifically noted on drawing.

B. Rating: All disconnect switches to be 600 volt, with current and/or horsepower ratings as shown on drawings.

C. Enclosure type: Unless otherwise indicated on the drawings, enclosure types shall be as follows:

1. Building interior (office areas only): NEMA Type 1
2. Building interior (manufacturing areas): NEMA Type 12
3. Exterior locations: NEMA Type 3R

3.03 IDENTIFICATION

A. Provide phenolic engraved nameplates. Indicate panel and circuit fed from.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. Section Includes:

1. Non-Fusible switches.
2. Receptacle switches.
3. Molded-case circuit breakers (MCCB).
4. Molded-case switches.
5. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined per ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory and component indicated. Include dimensioned elevations, sections, weights and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Field quality-control reports.

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise onsite testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 - deg F and not exceeding 104-deg F

2. Altitude: Not exceeding 6600 feet

1.08 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10-percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.01 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.

2. General Electric Company.

3. Square D

B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.

3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper conductors.

4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contacts, arranged to activate before switch blades open.

5. Hookstick Handle: Allows use of a hookstick to operate the handle.

6. Lugs: Mechanical type, suitable for number, size, and conductor material.

7. Accessory Control Power Voltage: As indicated.

2.02 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.

2. General Electric Company

3. Square D

B. General Requirements:

1. Comply with the following standards:
    a. UL 489
    b. NEMA AB 1
    c. NEMA AB 3
2. Interrupting capacity shall meet or exceed available fault currents.
3. Breakers sized 175 amps or greater shall be current limiting electronic trip units with LSI capability.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and response.

F. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring and Control."
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
9. Accessory Control Power Voltage: As indicated.

2.03 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 4X.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
5. Hazardous Areas Indicated on Drawings: NEMA 250, as indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.03 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 - Identification for Electrical Systems

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner shall engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section 26 05 73 "Overcurrent Protective Device Coordination Study".

END OF SECTION

SECTION 26 35 23 - ELECTROMAGNETIC-INTERFERENCE FILTERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Shield room power line filter

1.02 REFERENCES

1. NFPA 70-2017 National Electrical Code (NEC)
2. MIL-PRF-15733 General Military Test Methods
3. MIL-STD-202 Component Parts
4. MIL-STD-220 Insertion Loss
5. MIL-STD-285 Shielding Effectiveness

1.03 SUBMITTALS

A. Submit shop drawing, specification sheet, and evidence of UL listing/labeling for each filter assembly and each component device. If no filter with UL listing is available, the Contractor shall pay for the services of a certified testing agency to inspect and label the filter assembly.

B. Include outline dimensions, mounting or support point dimensions, voltage rating, current rating, number of filters in the assembly, weight of the total assembly and any optional add-ons that are to be included.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Universal Shielding Corporation

B. Genisco Filter

C. Substitutions: Any substitution and/or deviation from these specifications must be approved by the Project Electrical Engineer prior to fabrication and delivery.

2.02 POWER FILTERS

A. Voltage rating 208Y/120, 3-phase, 4-wire.

B. Ampere Rating: 60A minimum.

C. Filter Type: low pass, with minimum of 100 dB isolation from 15 kHz to 10 GHz.

D. Voltage Drop: 2% maximum at full rated load.

E. Insulation Resistance: per MIL-PRF-15733.

F. Harmonic Distortion: maximum of 4% at full rated load.

G. Temperature Rating: per MIL-PRF-15733.

H. Insertion Loss: minimum of 100 dB from 15 kHz to 10 GHz.

I. Enclosure: 14 or gauge or thicker steel, wall mounted, RF gasket providing minimum 100 dB shielding between 15 kHz and 10 GHz.

J. UL Listing: provide a device with UL listing, or provide the services of a local certified inspection organization to obtain an equivalent label.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install high on an outside wall of each ICD 705 room (to minimize intrusion on the area outside the room), directly opposite the 208V panelboard to be installed inside the ICD 705 room.

B. Connect the filter output to the panel inside the room utilizing a threaded nipple of the appropriate length to penetrate the shield room wall and insert into a threaded conduit fitting.

C. Install the filter in accordance with the details indicated on the project documents, including the plywood on the outside of the ICD 705 room and the steel plate on the inside of the room.

3.02 FIELD QUALITY CONTROL

A. Test the finished installation in accordance with MIL-PRF-15733. Make any modifications necessary to meet the specifications listed in this document.

END OF SECTION

SECTION 26 43 13 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes Transient Voltage Surge Suppression (TVSS) referred herein as Surge Suppression Device (SPD) for applications 600 Volts & below.

1.02 RELATED DOCUMENTATION

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

B. Related Sections include the following:

1. Section 26 24 16 – Panelboards

1.03 DEFINITIONS

1. ATS: Acceptance Testing Specifications.
2. VPR: Voltage Protection Rating.
3. SPD: Surge Protective Device, replacement acronym for TVSS: Transient Voltage Surge Suppressor
4. CLF: Component Level Fusing
5. LIC: Low Impedance Cable
6. SCCR: Short Circuit Current Rating
7. LTV: Let Through Voltage

1.04 STANDARDS

A. All manufacturers must comply with the standards listed below and any additions current revisions of industry standards. All products that do not comply with current industry standards will not be accepted.

1. Underwriters Laboratories 1449 – (UL 1449) 3rd Edition
2. NEC article 285. National Electrical Code 2017
3. NFPA 780 Standard for the installation of lightning protection systems
4. UL96A – Lightning Protection System Master Label
5. IEEE (Institute of Electrical and Electronic Engineering Inc.) Latest Revision
    a. C62.41.1, C62.41.2, C62.45, & C62.35

1.05 APPLICATIONS

A. Distribution panels and branch panels as noted on the project's drawings and/or panel schedules.

1.06 SUBMITTALS

A. The vendor/manufacturer shall submit 3 copies of all related TVSS Specifications, product data, electrical and mechanical shop drawings, installation requirements/instructions, maintenance

manuals (if applicable) and performance/warranty information requested in this document for the actual proposed TVSS/SPD device(s) to Project Engineer. All information shall be submitted in a three ring binder indexed by response and test. Project Engineer reserves the right to select or reject any vendor response or product.

B. For TVSS device to be considered for this project, all responses to information requested in this specification must be provided in writing and must reference each specification section and sub-section herein. Attach information as necessary to provide compliance with specification response requirements. If a manufacturer cannot fully comply with a section of the specification, this must be stated in the response and the reason for non-compliance shall be provided.

C. All specs, listings and warranty information must be included on the manufacture's published product cut/spec sheets (unless noted otherwise) to be considered relevant for review.

1.07 QUALITY ASSURANCE

A. Warranty:

1. SPD Manufacturer's Warranty: shall provide a product warranty for a period of not less than ten (10) years from date of installation. Warranty shall cover unlimited, complete replacement of TVSS devices during the warranty period with no exceptions for lightning, utility accidents etc.

2. General Warranty: Special warranties 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. Experience: Those firms responding to this specification shall provide proof that they have been regularly engaged in the design, manufacturing and testing of TVSS for not less than five (5) years.

C. Continuity: All SPDs for this project must be supplied by the same manufacturer.

PART 2 - PRODUCTS

2.01 Acceptable "Pre-Approved" Manufacturers/Models

A. Total Protection Solutions – Contact "Power Solutions NW" (206) 930-1980

Total Protection Solutions (TPS) ServiceTrack & LowProfile Series					
Voltage / Application	480Y277v 3 Phase Wye	480v 3 Phase Delta	208Y120v 3 Phase Wye	208v 3 Phase Delta	120/240v Single / Split Phase
Distribution, MCC & Branch Panels	LP120-3Y480-FL	ST120-480NN-FL	LP120-3Y208-FL	ST120-240NN-FL	LP120-1S240-FL

B. Liebert – Contact "Campbell Company" (206) 763-5000

Liebert Interceptor II Series

Voltage / Application	480Y277v 3 Phase Wye	480v 3 Phase Delta	208Y120v 3 Phase Wye	208v 3 Phase Delta	120/240v Single / Split Phase
Distribution, MCC & Branch Panels	SI016-277YANSE	SI016-480DANSE	SI016-120YANSE	SI016-208DANSE	SI016-120SANSE

C. Current Technology – Contact “Integrated Power Systems” (425) 450-0051

Current Technology TransGuard Series					
Voltage / Application	480Y277v 3 Phase Wye	480v 3 Phase Delta	208Y120v 3 Phase Wye	208v 3 Phase Delta	120/240v Single / Split Phase
Distribution, MCC & Branch Panels	TG-60-277/480-3GY-M-L2	TG-60-480-DG-M-L2	TG-60-120/208-3GY-M-L2	TG-60-208-3DG-M-L2	TG-60-120/240-2G-M-L2

2.02 Surge Current Ratings: Minimum Single Impulse Ratings with Independent testing per previous NEMA LS1.

Distribution, MCC & Branch Panels	120kA per Phase, 60kA per Mode

2.03 Listings: UL1449 3rd Edition, UL96A & NFPA 780 (or current revision):

A. Type 1 & 2: Suitable for applications including direct bus connection with no additional overcurrent protection requirements.

B. Nominal Discharge Current (In): 10kA.

C. SCCR: 200KA Short Circuit Current Rating with no additional/external overcurrent protection.

2.04 Modes of protection - All modes for all configurations and:

A. WYE: Discrete MOV Line to Neutral, Line to Ground & Neutral to Ground

B. Delta: Discrete MOV Line to Line & Line to Ground

C. Sinewave tracking transient filter protection for all modes Wye & L-L for Delta.

2.05 Durability Testing: TVSS/SPD devices shall withstand a minimum of 5,000 hits delivered at a rate of one pulse per minute. Unit shall not fail or suffer let through voltage degradation of more than 7%. Lead length for testing and let through measurements shall be 6".

2.06 Component Level Fusing: Balanced array MOV based SPD/TVSS with individual Component Level Fusing (Oxygen Free High Conductivity [OFHC] elements in silica sand) are required for all components.

2.07 SPD must not have, use or require any of the following:

A. Board trace fuses, crowbar type gas tube arrestors or SAD devices are not allowed.

B. Integrated primary overcurrent protection Fuses or Circuit Breakers are not allowed.

C. SPDs with external over-current protection requirements (UL Type-2 listing only) are not allowed.

2.08 Safety: SPD must not fail catastrophically when a continuous over-voltage is applied to 6 modes simultaneously (Line-Neutral & Line-Ground * 3 Phases). UL1449 only requires one mode be tested at a time.

2.09 Monitoring: Green "Phase Status" LEDs, Red "Service Required" LED. SPD must not rely solely on primary overcurrent protection (no CLF), as this will likely open up on SPD failure.

2.10 Service Conditions: SPDs shall be rated for continuous operation under the following conditions, unless otherwise indicated:

A. Maximum Continuous Operating Voltage (MCOV) above nominal – Minimum 115%.

B. Enclosures: Heavy duty, powder coated steel with appropriate NEMA rating for application.

C. Operating Temperature: -10 to 110 deg F (-23 to 43 C).

D. Humidity: 0 to 85 percent, non-condensing.

E. Altitude: Up to 13,000 feet (4,000 m) above sea level.

F. Noise Level: SPD shall not emit any audible noise unless "in alarm" indicating a "service required" condition.

2.11 Maximum Let Through Voltages (LTV) – Tested w/6" leads & 500MHz Scope from 0 ref per NEMA-LS1

MCC, DISTRIBUTION & BRANCH PANEL APPLICATIONS

480/277 Wye	UL VPR – 6 kV/3kA	1200	1200	2000	1200	90º
	IEEE A3 – 6kV – 200A	71	119	73	67	180º
	IEEE A1 – 2kV – 67A	27	52	39	48	180

120/208 Wye	UL VPR – 6 kV/3kA	700	700	1200	700	90º
	IEEE A3 – 6kV – 200A	56	81	88	112	180º
	IEEE A1 – 2kV – 67A	29	46	39	40	180º

PART 3 - EXECUTION

3.01 PRE-INSTALLATION

A. Review all installation information in manufacturer's installation manual prior to installing SPD's

3.02 INSTALLATION

A. GENERAL

1. Verify all voltages before connecting to avoid injury and damage to equipment.
2. The SPD's shall be installed external to panelboard.
3. Internally mounted SPD's will not be accepted.
4. Ground resistance shall be 25 ohms or less per NEC Article 250.56
5. Suppressors shall be installed per the manufacturer's installation instructions and the requirements of: the NEC, the local authority having jurisdiction and the project engineer.
6. Project Engineer or their appointed representative may perform inspection of the installed suppressors and reserves the right to require corrections to the installation to comply with manufacturer's installation requirements and project specifications.
7. All circuit breakers feeding SPDs much have locking safety clips installed to prevent the circuit breaker from being inadvertently being turned off.

B. SECONDARY SPDs FOR DISTRIBUTION & BRANCH PANELS

1. Install one secondary suppressor at each Distribution Panel, Branch Panel & Sub-Panel location as indicated on the drawings.
2. Provide a 30 Amp circuit breaker (with a safety clip to ensure the circuit breaker cannot be inadvertently turned off) in the panel being protected as over-current protection for the wire and as a disconnecting means for the SPD.
    a. Only UL1449 Type-1 devices are allowed, so by definition of Type-1, the manufacture cannot have any external overcurrent protection requirements. If the SPD manufacture does have external overcurrent protection requirements, that SPD equipment will not be accepted.
3. Conductors between suppressor and point of attachment to the panelboard shall be kept as short and straight as possible. Mount the TVSS directly adjacent to the circuit breaker closest to the neutral bus, such that the maximum length of all connecting wiring is kept as short as possible, not to exceed 18 inches.
4. Over-length SPD leads (greater than 18") must be twisted together (2 twists/foot) and securely tie-wrapped once per foot to reduce impedance of the leads. Quality compression butt-splice connections are required when extending SPD leads (wire nuts are not acceptable).
5. Grounding: Suppressor's ground lead shall be bonded to the panel enclosure with a small ground lug as close as possible to the TVSS mounting point. Conduit between the TVSS/SPD and the switchboard must provide secure electrical/mechanical connections.

a. Isolated Ground (IG) Applications: The ground lead is bonded to the SPDs metal enclosure, so a non-metallic conduit must be used to isolate the SPD from the panel enclosure. The ground lead must then be connected to the IG buss.

3.03 STARTUP SERVICE

A. Do not energize or connect panelboards to their sources until SPD's are installed and connected.

B. Do not perform insulation resistance "Hipot" tests of the distribution wiring with the SPDs installed/connected. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires and accessories

B. Emergency Lighting

C. Exit Signs

D. Lighting Fixture Supports

1.02 RELATED SECTIONS

1. Section 26 09 43 Network Lighting Controls

1.03 REFERENCED STANDARDS

1. ANSI C82.1 Specification for Fluorescent Lamp Ballasts
2. ANSI C82.4 Specifications for High-Intensity-Discharge Lamp Ballasts (Multiple Supply Type)
3. NEMA LE 2 H-I-D Lighting System Noise Criterion (LS-NC) Ratings
4. UL 924 Emergency Lighting and Power Equipment
5. UL 935 Fluorescent Lamp Ballasts
6. UL 1570 Fluorescent Lighting Fixtures
7. UL 1571 Incandescent Lighting Fixtures
8. UL 1572 High Intensity Discharge Lighting Fixtures

1.04 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00 – Submittal Procedures

B. Include outline Drawings, lamp and ballast/driver data, support points, weights, and accessory information for each luminaire type.

C. Submit manufacturer's installation instructions under provisions of Section 01 33 00 – Submittal Procedures.

D. Submit the manufacturer’s installation manual & equipment specific proposed startup documents as a part of the initial equipment submittal.

E. Light fixture substitutions not permitted unless approved.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 1.

B. Store and protect products under provision of Division 1.

C. Ship laminated finish wood poles individually wrapped in moisture-resistant paper.

PART 2 - PRODUCTS

2.01 INTERIOR LUMINAIRES AND ACCESSORIES

A. PRODUCT TYPE/MANUFACTURER

1. See plan drawings

B. WIRING

1. Wiring shall be as required by code for fixture wiring.
2. Flexible cord wiring between fixture components or to electrical receptacle and not in wireways shall have a minimum temperature rating of 105°C.
3. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.
4. No internal wiring shall be visible at normal viewing angles, i.e. above 45° from vertical.

PART 3 - EXECUTION

3.01 LIGHTING SUPPORT

A. LED Recessed Type: Mount in frames suitable for the ceiling, with recessed portion of the fixture securely supported from the ceiling framing. Bottom of light fixture to be flush with adjacent ceiling. Fixture trim shall totally conceal ceiling opening. Provide two #14 earthquake chains or #12 wires when fixture is supported by ceiling suspension system.

B. Troffer type: For light fixtures supported by the ceiling suspension system, provide four Caddy #515 support clips (one each corner) which lock light fixture to ceiling tees after light fixture is installed. In addition, provide for each light fixture two #14 earth-quake chains or #12 wires secured at diagonally opposite fixture corners (for fixtures weighing less than 56 pounds) to structural members above suspended ceiling. For plaster or gypsum board ceilings provide plaster frame compatible gypsum board ceilings provide plaster frame compatible.

C. Surface Mounted Type:

1. Where mounted on accessible ceilings, support from structural members above ceiling by means of hanger rods through ceiling or as approved.
2. Continuous Runs of Fixtures: Laser sight to assure fixtures are straight when sighting from end to end, regardless of irregularities in the ceiling. Where light fixtures are so installed, omit ornamental ends between sections.
3. Where ceiling is of insufficient strength to support weight of lighting fixtures installed, provide additional framing to support as required.

3.02 COMMISSIONING

A. Contractor and Equipment Manufacturer's Participation in Project Commissioning

1. Assist in developing the final functional test procedures as specified in Sections 019113, 26 08 00 and related sections.
2. Provide authorized startup technician to perform functional performance testing as specified in Sections 01 91 13, 26 08 00 and related sections.
3. Provide building commissioning support as specified in Sections 01 91 13, 26 08 00 and related sections.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts or drivers.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

B. Substitutions:

1. Bidders requesting approval to provide products other than those specifically listed in the Light Fixture Schedule shall submit requests in writing to the design engineer ten days prior to the close of the bid period. Approval will be in the form of an addendum to the specifications issued to all registered plan holders. No requests for substitution will be considered after this date.
2. Substitution request shall include all information required under paragraph 1.06 SUBMITTALS. Requests for approval shall be accompanied by a working fixture sample (including lamps and a cord and plug). Provide the name of at least one installation where each proposed substitute has been installed for at least six months along with the name and phone number of the Architect, Owners representative and the Lighting Designer of Record. If required by the owner’s representative, the proposed substitutes must be installed at the bidder's expense in a location selected by the owner’s representative.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast, reflector, wiring and housing.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.04 REFERENCES

A. National Electrical Manufacturer’s Association (NEMA) LE5-1993:

1. Procedure for determining Luminaire efficiency ratings.

B. Underwriters Laboratories, Inc. (UL):

UL 542:	Lampholders, Starter Holders for Fluorescent Lamps
UL 924:	Emergency Lighting and Power Equipment
UL 935:	Fluorescent Lamp Ballasts
UL 1012:	Power Units Other Than Class 2
UL 1029:	HID Lamp Ballasts
UL 1310	Class 2 Power Units
UL 1570:	Fluorescent Lighting Fixtures
UL 1572:	High Intensity Discharge Lighting Fixtures
UL 1598:	Luminaires

1.05 SYSTEM DESCRIPTION

A. Exterior light fixtures include but are not limited to wall-mounted fixtures illuminating the wall, sidewalk, road, door, or other outdoor area; pole-mounted fixtures; fixtures mounted on or beneath canopies; and rooftop lighting.

B. Light fixture schedule series numbers are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of lamp, ballast, finish trim, ceiling type, mounting hardware, ceiling trim or special requirements as specified hereinafter or as required by the particular installations. Provide complete fixtures to correspond with the number of lamps, wattage, light distribution and/or size specified.

C. If there are discrepancies between fixture illustrations and the written description in the fixture schedule, the written description in the fixture schedule shall take precedence.

D. Light fixture voltage shall match voltage of circuit serving the light fixture.

1.06 SUBMITTALS

A. Submit the manufacturer’s installation manual & equipment specific startup documents as a part of the initial equipment submittal.

1.07 ACTION SUBMITTALS

A. For custom or modified fixtures, submit scaled drawings prepared by the manufacturer showing details of construction, lengths of runs, pendant and power feed locations, accessory pieces, finishes, and list of materials. Contractor to provide manufacturer with field dimensions where required.

B. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.

2. Details of attaching luminaires and accessories.

3. Details of installation and construction.

4. Luminaire materials.

5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.
8. Lamps, including brand name, product name, rated life, output, CCT and CRI.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

1.08 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO-LTS-5 and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.09 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.10 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. LED Fixtures: Provide one case or 10% (whichever is less) of each type used on the project. Turn over to Owner and obtain signed receipt.

2. Lamps: Provide one case or 10% (whichever is less) of each type used on the project. Turn over to Owner and obtain signed receipt.

3. Ballasts: Provide one case or 10% (whichever is less) of each type used on the project. Turn over to Owner and obtain signed receipt.

4. Fuses: Provide one case or 10% (whichever is less) of each type used on the project. Turn over to Owner and obtain signed receipt

1.11 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.13 WARRANTY

A. Ballasts: Provide manufacturer’s warranty for a period of not less than five years. Warranty shall include parts and labor to replace defective ballasts.

B. LED Luminaires: Provide manufacturer's warranty for a period of not less than three years for repair or replacement of defective electrical parts, including light source, drivers and power supplies.

C. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.

2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.

3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL MATERIAL REQUIREMENTS

A. Finish mounting hardware and accessories to prevent corrosion and discoloration to adjacent materials.

B. For weatherproof or vapor tight installations, painted finishes of fixtures and accessories shall be weather resistant enamel using proper primers or galvanized and bonderized epoxy, so that the entire assembly is completely corrosion resistant for the service intended. Where aluminum parts come into contact with bronze or steel parts, apply a coating material to both surfaces to prevent corrosion.

C. Non-vapor tight fixtures to have 1/8” dia. weep holes as required for proper drainage. Weep holes to be configured to prevent light leaks.

D. Fixtures shall be free of light leaks and designed to provide sufficient ventilation of lamps to provide the photometric performance required. Ballasts and transformers shall be adequately vented.

E. Lampholders shall hold lamps securely against normal vibrations and maintenance handling.

F. Reflector Cones:

1. Provide minimum 45° lamp and lamp image cut-off for all vertically mounted lamps. For horizontal lamps provide minimum 33° cut-off. There shall be no visible lamp flashing in the cone.

2. Plastic materials shall not be used for reflector cones, unless noted otherwise in the Light Fixture Schedule.

3. Reflector cones shall not be riveted or welded to housing and shall be removable without tools. Retention devices shall not deform the cone in any manner. Trim shall be flush with finished ceiling without gaps or light leaks. Where the flange trim is separate from the cone, it shall have the same finish as the cone.
4. Reflector cones shall be of uniform gauge, not less than 0.032-inch thick, high purity aluminum Alcoa 3002 alloy, free of spin marks or other defects.
5. Manufacture reflector under the Alzak process. Refer to fixture schedule for cone color and specular or diffuse finish requirements. For fixtures using compact fluorescent lamps, provide additional finish equivalent to Color-Chek that eliminates iridescence. Submit one sample of each cone type for review when required in the fixture schedule.

G. Fresnel Lens and Door Assembly:

1. Lens shall have uniform brightness throughout the entire visible area at angles from 45° to 90° from vertical, without bright spots or striations.
2. Lens shall have opaque risers painted neutral gray unless otherwise specified in the Light Fixture Schedule.
3. Finish of regress door shall be matte baked enamel paint in color as selected by the owner.

H. Light fixtures containing lamps which require protective shielding shall have tempered clear glass lenses, unless noted otherwise in the Light Fixture Schedule.

I. For adjustable fixtures, provide positive locking devices to fix aiming angle. Fixture shall be capable of being relamped without adjusting aiming angle.

J. Safety: Provide safety devices for removable fixture elements (cones, reflectors, lenses, etc.) to support removable elements when not in normal operating position. Safety devices shall be detachable if necessary and shall not interfere with fixture performance, maintenance or the seating of any fixture element, and not be visible during normal fixture operation. Safety device shall be made of corrosion resistant materials.

K. Finishes:

1. Painted surfaces shall have an outdoor life expectancy of not less than 20 years without any visible rust or corrosion.
2. Finishes to comply with requirements set by the American Architectural Manufacturers Association (AAMA):
    a. Baked on enamel and high performance powder coating finish on aluminum: AAMA 304-05
    b. Anodized aluminum: AAMA 611-98
    c. Clear coat on aluminum: AAMA 612-02
3. Finish colors shall be as specified.

L. Diffusers: materials shall be UV stabilized.

2.02 LIGHT EMITTING DIODE (LED) FIXTURES

A. Housing: Rigid aluminum construction.

B. Finish: Visible surfaces. Powder coated paint or natural aluminum as specified in Light Fixture Schedule. Color and finish as selected by the owner. Concealed parts, (lamp holders, yokes, brackets, etc.) matte black.

C. Lamp Holder Housing: Cast aluminum with integral heat radiating fins to assure cool lamp base operation, with sufficient heat dissipation to meet device manufacturer's guidelines for junction temperature, certification programs, and test procedures for thermal management.

D. Off-state Power: Luminaires shall not draw power in the off state. Exception: Luminaires with integral occupancy, motion, photo-controls or individually addressable fixtures with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

2.03 WIRING

A. Wiring shall be as required by code for fixture wiring.

B. Flexible cord wiring between fixture components or to electrical receptacle and not in wireways shall have a minimum temperature rating of 105°C.

C. Cords shall be fitted with proper strain reliefs and watertight entries where required by application.

D. No internal wiring shall be visible at normal viewing angles, i.e. above 45° from vertical.

2.04 POWER SUPPLIES:

A. LED Power Supplies:

1. Minimum power factor 90%.

2. Minimum operating temperature of -20°C.

3. Output operating frequency shall be minimum 120 Hz.

4. Power supply shall meet FCC requirements for non-consumer use.

5. Sound rating: Class A.

6. Power supply shall comply with IEEE C.62.41-1991, Class A operation.

2.05 LAMPS

A. Each lamp type in the Project shall be manufactured by the same manufacturer.

B. Light Emitting Diode Type:

1. LED modules/arrays shall have a minimum CRI of 75 unless otherwise specified in the Light Fixture Schedule.

2. Color temperature variation shall not exceed +/- 100 degrees Kelvin at installation, and +/- 200 degrees Kelvin over the life of the module. CCT shall be 5000K unless otherwise noted in the Light Fixture Schedule.

3. LED modules/arrays shall deliver at least 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.

4. Mechanically fasten board to heat sink as required to meet LED manufacturer's heat dissipation requirements.

5. Acceptable manufacturers: Lithonia, Hubbell, Philips (Lumileds), Osram, GE, or as noted in light fixture schedule.

2.06 LIGHTING STANDARDS

A. Pole/Luminaire Assemblies and Bollards: Supply luminaires, davit arms, brackets, poles, handhole covers, base components and all other accessories for a complete assembly. Manufacturer shall be responsible for proper fitting of all elements and the structural integrity of the unit. Provide assembly to withstand 100 mph steady wind rated poles with 1.3 gust factor.

B. Provide watertight insulating fuse and holder in the base of each lighting standard to individually protect each lighting fixture. Fuse holder similar to Buss style "HEX" (HEB permitted for 120V or 277V), with Buss fuse of appropriate ampacity and voltage. Provide fuse for each hot circuit wire; do not fuse neutral.

C. Provide nameplate on handhole of each light pole. Nameplate to indicate pole identification number, source panelboard, and circuit number per lighting drawings.

2.07 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-6.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.

2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.

2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place or precast, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Precast poles shall be Old Castle Precast round lamp base footing or approved equivalent.

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A36 and hot-dip galvanized according to ASTM A153; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO-LTS-6.

H. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-6.

I. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-6.

J. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-6 Ice Load Map.

K. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-6.

1. Basic wind speed for calculating wind load for poles exceeding 50 feet in height is 90 mph.
    a. Wind Importance Factor: 1.0.
    b. Minimum Design Life: 50 years.
    c. Velocity Conversion Factors: 1.0.
    d. Elevated Locations: Include as required per AASHTO LTS-6: 3.8.2.1.
    e. Special Wind Regions: Include as required per AASHTO LTS-6: 3.8.2.2.
2. Basic wind speed for calculating wind load for poles 50 feet high or less is 90 mph.
    a. Wind Importance Factor: 1.0.
    b. Minimum Design Life 25 years.
    c. Velocity Conversion Factors: 1.0.
    d. Elevated Locations: Include as required per AASHTO LTS-6: 3.8.2.1.

e. Special Wind Regions: Include as required per AASHTO LTS-6: 3.8.2.2.

2.08 STEEL POLES

A. Poles: Comply with ASTM A500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 30 feet in height with access handhole in pole wall.

1. Shape: Square, straight.

2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with galvanized-steel bolts.

2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.

3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.

I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A123.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove

mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."

2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.

3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

   a. Finish colors shall be as specified.

2.09 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B429, Alloy 6063-T6; one-piece construction up to 30 feet in height with access handhole in pole wall.

B. Poles: ASTM B209, 5052-H34 marine sheet alloy with access handhole in pole wall.

1. Shape: Round, straight, or per schedule.

2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.

2. Finish: Same as luminaire.

F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating:

Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

2.10 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.01 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming.

3.02 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches

2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.

3. Trees: 15 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.

2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.

3. Install base covers unless otherwise indicated.

4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Dig holes large enough to permit use of tampers in the full depth of hole.
2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Raise and set poles using web fabric slings (not chain or cable).

3.03 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode conductor to each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

3.04 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
1. Verify operation of photoelectric controls.

END OF SECTION

SECTION 26 60 00 – SYSTEM COORDINATION AND ARC FLASH STUDY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Arc flash evaluation, study and report

B. Arc flash labeling

C. Normal Standby Source Breaker Coordination

D. Optional Standby Source Breaker Coordination

E. Legally Required Standby Breaker and Fuse Coordination

F. Legally Required Standby and Emergency System Breaker and Fuse Coordination

1.2 RELATED SECTIONS

A. Section 262416 Panelboards

B. **REFERENCES**

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems

2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis

4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings

5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in
Industrial and Commercial Power Systems.

6. IEEE 1584 (2004) - Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures

3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated On a Symmetrical Current Basis

4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code, latest edition

2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.3 SCOPE OF WORK

A. The contractor shall furnish short-circuit and protective device coordination studies

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E - Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

C. The scope of the studies shall include all existing and new distribution equipment under this contract

1.4 PRE-SUBMITTALS

A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and to ensure that the selection of device and characteristics will be satisfactory.

1.5 SUBMITTALS

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Five (5) bound copies of the complete final report shall be submitted. Additionally all of the short-circuit input and output data and reports shall be provided on CD in PDF format.

B. For large system studies with more than 200 bus locations, the contractor is required to provide the study project files to the Owner in electronic format. In addition, a copy of the computer analysis software viewer program is required to accompany the electronic project files, to allow the Owner to review all aspects of the project and print arc flash labels, one-line diagrams, etc.

C. The report shall include the following sections:

1. Executive Summary.

2. Descriptions, purpose, basis and scope of the study

3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated

short circuit duties

4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection

5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout

6. Details of the incident energy and flash protection boundary calculations

7. Recommendations for system improvements, where needed

8. One-line diagram

D. Arc flash labels shall be provided in hard copy only.

1.6 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted by PowerStudies.com.

B. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer.

C. The Registered Professional Electrical Engineer shall be a full-time employee of an approved engineering firm.

D. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

E. The equipment approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least five actual arc flash hazard analysis it has performed in the past year

1.7 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using the latest revision of the SKM Systems Analysis Power Tools for Windows.

PART 2 - PRODUCTS

2.1 STUDIES

A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved engineering firm.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E – Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.2 DATA COLLECTION

A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit; protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT CIRCUIT AND PROTECTIVE DEVICE

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.

B. Transformer design impedances shall be used when test impedances are not available.

C. Provide:

1. Calculation methods and assumptions

2. Selected base per unit quantities

3. One-line diagram of the system being evaluated

4. Source impedance data, including electric utility system and motor fault contribution characteristics

5. Tabulations of calculated quantities

6. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:

1. Electric utility’s supply termination point

2. Incoming switchgear

3. Unit substation primary and secondary terminals

4. Low voltage switchgear

5. Motor control centers

6. Standby generators and automatic transfer switches

7. Branch circuit panelboards

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings

2. Evaluate the adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses

3. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:

1. Electric utility’s overcurrent protective device

2. Medium voltage equipment overcurrent relays

3. Medium and low voltage fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands

4. Low voltage equipment circuit breaker trip devices, including manufacturer’s tolerance bands

5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves

6. Conductor damage curves

7. Ground fault protective devices, as applicable

8. Pertinent motor starting characteristics and motor damage points, where applicable

9. Pertinent generator short-circuit decrement curve and generator damage point

10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 -2004.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.

D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.

2. Fault contribution from synchronous motors and generators should be decayed to match

   the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

H. For each equipment location with a separately enclosed main device (where there is

adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.6 REPORT

A. Input data shall include, but not be limited to the following:

1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).

2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.

3. Reactor data, including voltage rating, and impedance.

4. Generation contribution data, (synchronous generators and Utility), including short-circuit
reactance (X”d), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.

5. Motor contribution data (induction motors and synchronous motors), including shortcircuit
reactance, rated horsepower or kVA, rated voltage, and X/R ratio.

B. Short-Circuit Output Data shall include, but not be limited to the following reports:

1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:

a. Voltage
b. Calculated fault current magnitude and angle
c. Fault point X/R ratio
d. Equivalent impedance

2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:

a. Voltage
b. Calculated symmetrical fault current magnitude and angle
c. Fault point X/R ratio
d. Calculated asymmetrical fault currents

1. Based on fault point X/R ratio
2. Based on calculated symmetrical value multiplied by 1.6
3. Based on calculated symmetrical value multiplied by 2.7

e. Equivalent impedance

3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:

a. Voltage
b. Calculated symmetrical fault current magnitude and angle
c. Fault point X/R ratio
d. No AC Decrement (NACD) Ratio
e. Equivalent impedance
f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis

C. Recommended Protective Device Settings:

1. Phase and Ground Relays:

a. Current transformer ratio
b. Current setting
c. Time setting
d. Instantaneous setting
e. Recommendations on improved relaying systems, if applicable.

2. Circuit Breakers:

a. Adjustable pickups and time delays (long time, short time, ground)
b. Adjustable time-current characteristic
c. Adjustable instantaneous pickup
d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations

1. Arcing fault magnitude

2. Protective device clearing time

3. Duration of arc

4. Arc flash boundary

5. Working distance

6. Incident energy

7. Hazard Risk Category

8. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Owner in writing of any required major equipment modifications

3.2 ARC FLASH WARNING LABELS

A. The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

C. The label shall include the following information, at a minimum:

1. Location designation

2. Nominal voltage

3. Flash protection boundary

4. Hazard risk category

5. Incident energy

6. Working distance

7. Engineering report number, revision number and issue date.

D. Labels shall be machine printed, with no field markings.

E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 600, 480 and applicable 208 volt panelboard, one arc flash label shall be provided.

2. For each motor control center, one arc flash label shall be provided.

3. For each low voltage switchboard, one arc flash label shall be provided.

4. For each switchgear, one flash label shall be provided.

5. For medium voltage switches one arc flash label shall be provided

F. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.3 ARC FLASH TRAINING

A. The contractor of the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours).

END OF SECTION

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior chain-link fences.
2. Interior swing gates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.
3. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Sample Warranty: For special warranty.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height and under exposure conditions indicated according to ASCE/SEI 7.
   1. Minimum Post Size: Determine according to ASTM F1043 for post spacing not to exceed 10 feet (3 m) for Material Group IA, ASTM F1043, Schedule 40 steel pipe.
      a. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

   1. Fabric Height: 10 feet, or as indicated on Drawings.
   2. Steel Wire for Fabric: Wire diameter of 0.148 inch (3.76 mm)

      a. Mesh Size: 2 inches (50 mm)
      b. Zinc-Coated Fabric: ASTM A392, Type II, Class 1, 1.2 oz./sq. ft. (366 g/sq. m) with zinc coating.

   3. Selvage: Twisted top and knuckled bottom.

2.3 FENCE FRAMEWORK

A. Posts and Rails ASTM F1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F1043 based on the following:

   1. Fence Height: 10 feet.

   2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.

      a. Line Post: 2.875 inches (73 mm) in diameter.
      b. End, Corner, and Pull Posts: 2.875 inches (73 mm) in diameter).

3. Horizontal Framework Members: Intermediate, top and bottom rails according to ASTM F1043.

    a. Top Rail: 1.66 inches (42 mm) in diameter.

4. Brace Rails: ASTM F1043.
5. Metallic Coating for Steel Framework:

    a. Type A: Not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating according to ASTM A123/A123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating according to ASTM A653/A653M.

2.4 HORIZONTAL-SLIDE GATES

A. General: ASTM F1184 for gate posts and single sliding gate types.

1. Classification: Type I Overhead Slide.

    a. Gate Leaf Width: 10 feet.
    b. Framework Member Sizes and Strength: Based on gate fabric height 10 feet.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Protective coating and finish to match fence framework.
2. Gate Posts: ASTM F1184. Provide round tubular steel posts.

C. Frame Corner Construction: Welded.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 12 inches (300 mm) as required to attach barbed tape assemblies.

E. Overhead Track Assembly: Manufacturer's standard track, with overhead framework supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.

F. Hardware:

1. Hangers, Roller Assemblies, and Stops: Fabricated from galvanized steel.
2. Lock: Deadbolt with interchangeable core internal device.

2.5 FITTINGS

A. Provide fittings according to ASTM F626.

2.6 BARBED TAPE

A. Wire-Reinforced Tape: ASTM F1910; continuous coils with four-point, needle-sharp barbs permanently cold clenched around a core wire.

2.7 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F567 and more stringent requirements specified.

B. Post Setting: Set posts with mechanical anchors at indicated spacing to concrete slab.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

C. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more

D. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches (1830 mm) or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and

terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

G. Intermediate and Bottom Rails: Secure to posts with fittings.

H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch (25-mm) bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.

J. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.3 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.4 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113