

**New Facility Specifications
Including Relevant Site Work For**



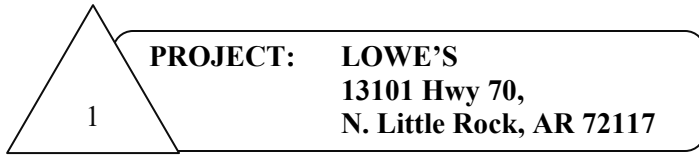
of

N. Little Rock, AR

Specification Date: 04/22/26

Bid Date: 04/22/26

SECTION 00005 SEALS



ARCHITECT OF RECORD:

SGA Design Group, P.C.
1437 S Boulder Ave., Ste. 550
Tulsa, OK 74119

Architectural Sections: Division 1, 05500,
Divisions 6, 7, 8, 9, 10



04/27/2026

Digitally signed by
Jeffrey A Dalton
Date: 2026.04.27
17:09:08-05'00'

Architect of Record Date

SECTION 000107.02
SEALS PAGES - STRUCTURAL

1 STRUCTURAL ENGINEER OF RECORD

Benjamin B. Bailey

Johnston Burkholder Associates

930 Central Street

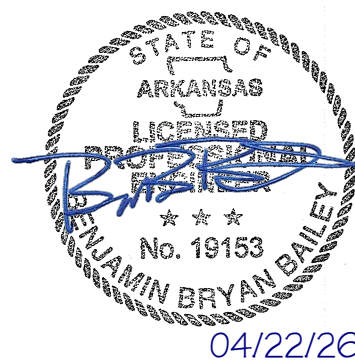
Kansas City, MO 64105

I hereby specify that the specification sections intended to be authenticated by my seal are limited to:

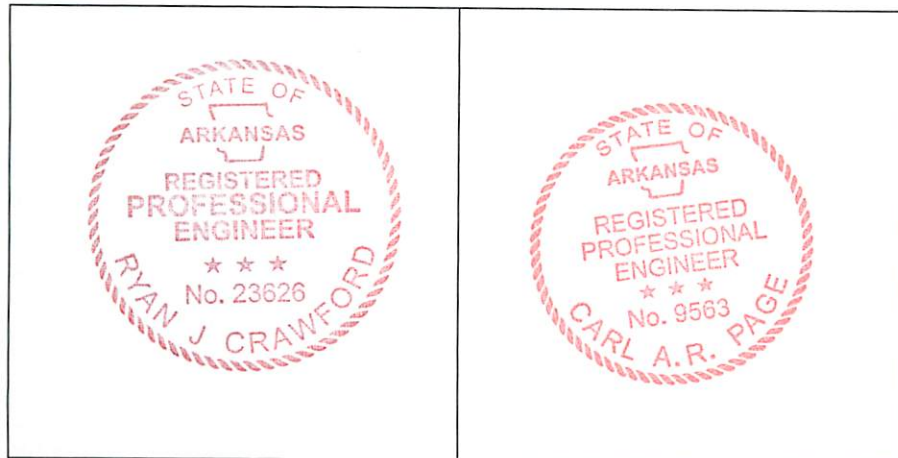
033000 CAST-IN-PLACE CONCRETE
054000 COLD FORMED METAL FRAMING
055000 METAL FABRICATIONS

STRUCTURAL ENGINEER OF RECORD

04/22/26



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P & M Seal
Division 15

Electrical Seal
Division 16

Lowe's of North Little Rock

N. Little Rock

Arkansas

City

State

P & M Signature

04.21.2026

Date

Electrical Signature

04.21.2026

Date

P, M, E Engineer of Record

Company Name: PAGE INTERWORKS, PA
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North Wilkesboro, NC 28659
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SECTION 00005 SEALS

PROJECT: LOWE'S
 1310 Hwy 70,
 N. Little Rock, AR 72117

FIRE PROTECTION ENGINEER OF RECORD:

Henderson Engineers
8345 Lenexa Drive, Suite 300
Lenexa, KS 66214



Fire Protection Sections: Division 13, Section 13916



4/20/2026

Fire Protection Engineer of Record

Date

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**GENERAL CONDITIONS AND SPECIFICATIONS FOR
A NEW STORE FACILITY
INCLUDING RELEVANT SITE WORK FOR
LOWE'S OF ANYWHERE
ANYWHERE, ANY STATE**

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SECTION 01100 - SUMMARY**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 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Project consists of a Lowe's Home Improvement store.
1. Project Location: ***13101 Hwy 70, North Little Rock, AR 72117.***
2. Owner: Lowe's Home Centers, Inc., Construction Department, 1000 Lowe's Blvd. Mooresville, NC 28117.
3. Work described in the Contract Documents includes the furnishing of all labor, materials or equipment specified or indicated on the drawings or reasonably inferred there from for the construction of a complete and usable facility.
- B. Project will be constructed under a general construction contract.
- C. The contractor is responsible for familiarizing himself with the contract documents.

1.03 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 0 and other Division 1 Specification Sections, apply to this Section.
- B. The Contract Documents consist of the Owner-Contractor Agreement, the General Conditions of the Contract, the drawings, the specifications and all addenda issued prior to and all modifications issued after execution of the Contract. A modification is either a written amendment to the Contract signed by both parties, a change order, a written interpretation issued by an Architect or other authorized representative of the Owner, or a written order for a minor (no cost) change to the work issued by the Owner's representative.

1.04 USE OF PREMISES

- A. General:
1. New Construction: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
2. Retrofit and Repair Construction: Contractor shall have full use of premises designated for the work and shall work to support and shall not interfere with retail operations during open-for-business hours. All work areas scheduled for closure to retail operations must be approved by the Lowe's Project Manager before beginning work. All areas approved for closure to retail operations shall be clearly delineated with barricades to allow customers free access to the retail facility and must be 100% complete before opening for public access. Contractor shall give at least (2) two weeks notice prior to material delivery or scheduled start date. Follow-up notice shall be given to the Store Manager at least (3) three days in advance of any construction.
- B. The Contractor shall verify all grades, levels, conditions and dimensions and shall make all necessary measurements at the job site. No extra charge will be allowed because of differences between actual measurements and the dimensions indicated on the drawings. Any difference noted shall be reported to the Owner for consideration before proceeding with the Work.

1.05 WORK UNDER OTHER CONTRACTS

- A. Separate Contract: Owner may award a separate contract or use Owner's personnel for performance of certain construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
- B. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.06 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS**2.01 OWNER – FURNISHED ITEMS**

- A. The Owner will furnish and the General Contractor will accept shipment, protect from damage and install the following items:
 - 1. Energy Management System, Electrical Distribution Panels and Step-Down Transformers as detailed on mechanical and electrical drawings.
 - 2. Sensormatic equipment for the Electronic Article Surveillance (EAS)
 - a. Floor Max System (ZAFM3-3) consists of the following:
 - 1) Power Pack (0100-0839-05)– quantity 1
 - 2) Cap Board Enclosure (ZPFM3ENC) – quantity 2
 - 3) Floor Max Antenna (ZSFM3ANT) – quantity 3
 - 4) Installation Kit (0351-0547-01)– quantity 1
 - b. Power Pack Enclosure (0100-1341-01) – quantity 3
 - 3. WeatherTRAK landscape irrigation controller package (controller, enclosure and rain sensor)
- B. The Owner will furnish and install the following items. The General Contractor to cooperate and coordinate with the Owner and/or Owner's sub contractor on the installation of the following:
 - 1. Lowe's road sign and building sign(s).
 - 2. Cart Return Racks

PART 3 - EXECUTION

- A. The Contractor shall receive, unload, and store the owner-furnished items in accordance with the manufacturer's recommendation. Owner-furnished items received and accepted by the Contractor becomes the Contractor's responsibility. Any damage to the owner-furnished items shall be repaired or replaced at the owner's option by the Contractor without an increase in time or cost.

END OF SECTION 01100

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 2 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General Project coordination procedures.
 - 2. Coordination Drawings.
 - 3. Project meetings.
- B. Related Sections include the following:
 - 1. Division 2 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
 - 2. Division 2 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

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

1.04 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- B. If necessary 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 and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.05 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Indicate relationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.
 3. See Division 23 Section "Basic Mechanical Materials and Methods" for specific Coordination Drawing requirements for mechanical installations.
 4. See Division 26 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for electrical installations.

1.06 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and other stakeholders of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner within three days of the meeting.
- B. SWPPP (Storm Water Prevention Pollution Plan) Preconstruction Conference: Schedule a SWPPP preconstruction conference before starting construction, at a time convenient to Owner. Hold the SWPPP preconstruction conference at Project site or another convenient location. Participate in the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner (meeting leader), Engineer, and their consultants; Contractor and its superintendent; earthwork subcontractors; any Federal, State or Local officials involved in review or inspection of the Project; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Overview of NPDES permitting and Lowe's Expectations.
 - b. Recordkeeping and retention.
 - c. Phasing of Project and Sequence of Construction
 - d. Review ESC Plans and BMP Details
 - e. Locating dumpster, toilets, concrete washout, fueling areas on site map and posting
 - f. Posting requirements for NOI, NOC and Construction Site Notice
 - g. Allowable non-stormwater discharges and handling procedures
 - h. Signatory authorizations and certification requirements
 - i. Spill kit
 - j. SPCC petroleum quantity limitations and SPCC Plan self certification
 - k. Materials management
 - l. Required inspection timeframes and recordkeeping requirements
 - m. Stabilization requirements and schedule
 - n. Implementation schedule and questions
 - o. Modification Reports and tracking plan amendments and stabilization progress on site map
 - p. Subcontractor training program
 - q. Modification procedures
 - r. Hazardous materials and critical incident and reportable quantity procedures
 - s. Final stabilization and Pre-NOT inspection requirement
 - t. Rainfall monitoring
 - u. Import/Export fill or spoil requirements
 - v. SWPPP accessibility to regulatory officials
 - w. State specific requirements
 - x. Assisting and cooperating with regulatory officials
 3. Meeting Attendance: Meeting attendances will be recorded on Form J-1 and placed in the SWPPP Ledger.

- C. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner. Hold the preconstruction conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. LEED requirements.
 - l. Preparation of Record Documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Construction waste management and recycling.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
 - x. Working hours.
 3. Minutes: Contractor will record and distribute meeting minutes.
- D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. The Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.

- q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- E. Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
- 1. Attendees: In addition to representatives of Owner, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Status of Change Orders.
 - 15) Documentation of information for payment requests.
 - 3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - 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.

1.07 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
 - 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Contractor.
 - 4. Name of Architect or Engineer.
 - 5. RFI number, numbered sequentially.
 - 6. Specification Section number and title and related paragraphs, as appropriate.
 - 7. Drawing number and detail references, as appropriate.
 - 8. Field dimensions and conditions, as appropriate.
 - 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 10. Contractor's signature.
 - 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Owner's Action: Owner/Architect/Engineer will review each RFI, determine action required, and return it. Allow 14 working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
 - 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 - 2. Owner/Architect/Engineer's action may include a request for additional information, in which case time for response will start again.
 - 3. Owner/Architect/Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Owner in writing within 10 days of receipt of the RFI response.
- D. On receipt of Owner's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Owner within seven days if Contractor disagrees with response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

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SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 2 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Submittals Schedule.
 - 3. Daily construction reports.
 - 4. Field condition reports.
 - 5. Lowe's Development and Design Criteria Section 800 "Stormwater Pollution Prevention Plan" Ledger
- B. See Division 00 for submitting Schedule of Values.
- C. See Division 2 Section "Payment Procedures" for submitting the Schedule of Values.
- D. See Division 2 Section "Photographic Documentation" for submitting construction photographs.

1.03 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner
- E. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- F. Major Area: A story of construction, a separate building, or a similar significant construction element.

1.04 SUBMITTALS

- A. Submittals Schedule: Submit four (4) copies of schedule. Submit to Owner within 14 days following contract award. Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category (action or informational).
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Architect's final release or approval.

- B. Contractor's Construction Schedule: Submit three (3) printed opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
 - 1. The Contractor shall submit to the Owner within fourteen (14) days following the contract award both a graphic and an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. The Construction Schedule Chart shall be as detailed as practical and shall show:
 - a. The project name
 - b. The Contractor's name
 - c. The date of submittal
 - d. Each major term of work
 - e. The proposed start date, duration, and completion date of each item of work,
 - f. The actual start date, duration and completion date of each item of work.
 - C. CPM Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - D. Daily Construction Reports: Submit two copies at weekly intervals.
 - E. Field Condition Reports: Submit two copies at time of discovery of differing conditions.
- 1.05 COORDINATION
- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
 - B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 - 2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion

2.03 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Preliminary Network Diagram: Submit diagram within 14 days of date established for the Notice of Award. Outline significant construction activities for the duration of the Work.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice of Award.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 3. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.
 - D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for all work.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Sub networks on separate sheets are permissible for activities clearly off the critical path.
 - E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
 1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Principal events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 - F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- 2.04 REPORTS
- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 1. Contractor's name
 2. Project Location
 3. Work Progress for the Day
 4. List of subcontractors at Project site.
 5. Number of workmen by trade employed on the project for that day
 6. Equipment at Project site.
 7. Material deliveries.
 8. High and low temperatures and general weather conditions.
 9. Accidents.
 10. Stoppages, delays, shortages, and losses.

11. Meter readings and similar recordings.
 12. Orders and requests of authorities having jurisdiction.
 13. Services connected and disconnected.
 14. Equipment or system tests and startups.
 15. Daily observation of level of sediment tracking at construction entrance/exit
 16. Daily observation of proper use and disposal of chemicals and substances stored or used on site.
 - B. The Contractor shall submit to the Owner at the end of each week Daily Progress Reports for each day of work during the preceding week. A report shall be submitted for each day of the contract duration even if no work is performed. Copies of reports shall be maintained at the site by the Project Superintendent.
 - C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation (RFI) to the Owner. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- 2.05 LOWE'S STORM WATER POLLUTION PREVENTION PLAN (SWPPP) LEDGER
- A. Required Record Keeping: Prepare and maintain as required by the written SWPPP all inspection, maintenance and construction activity reports for the Project site. Required reports include, but are not limited to the following:
 1. Contractor's NPDES Operator Certification Signature Page (only where Contractor is also considered an "Operator" for the Project)
 2. Form A-1 Signatory Authorization Designation Form (only where Contractor is also considered an "Operator" for the Project).
 3. Form B-1 General Contractor's Certification Form
 4. Form B-2 Subcontractor's Certification Form (for all subcontractors working on site)
 5. Form C-1 Weekly (and Rain Event) Inspection Report for each required inspection.
 6. Form C-2 Compliance Inspection Report (for Lowe's Project Manager and Third Party Inspector (when used)).
 7. Form C-3 Corrective Action Log
 8. Form D-1 Modification Report
 9. Form E-1 Subcontractor Training Report Form
 10. Form F-1 Final Inspection and Pre-Notice of Termination Report
 11. Form G-1 Critical Incident and Reportable Quantity Form
 12. Form G-2 SPCC Self-Certification Statement
 13. Form G-3 SPCC Facility Description and Potential Tank Equipment and Operational Equipment Failure Resulting in Spills
 14. Form H-1 Rainfall Log
 15. Form I-1 Construction Site Notice
 16. Form J-1 Pre-Construction Training Meeting Agenda
 17. Site Map(s) (to record locations of materials management measures throughout construction and document Modifications to the plan)
 18. Any additional Federal, State or Local Forms, Reports, or Certifications incorporated into the written SWPPP.
 - B. The Contractor shall submit to the Owner at the end of each month all Daily Progress Reports for each day of work during the preceding week. A report shall be submitted for each day of the contract duration even if no work is performed. Copies of reports shall be maintained at the site by the Project Superintendent.
 - C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation (RFI) to the Owner. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320

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PROJECT LOWE'S OF ANYWHERE CONTRACTOR LIGHTNING CONSTRUCTION DATE OF REPORT _____

[illegible]

LOWE'S OF N. LITTLE ROCK, AR

01/2025

PROJECT _____ CONTRACTOR _____ DATE OF REPORT _____

	SCHEDULED		CONTRACT DATE				COMPLETION DATE					
	DESCRIPTION	VALUE										100
1												
2												
3												90
4												
5												
6												80
7												
8												
9												70
10												
11												
12												60
13												
14												
15												50
16												
17												
18												40
19												
												30
												20
												10

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 2 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Division 0 Section "Application for Payment for Construction and Final Acceptance" for submitting Applications for Payment and the Schedule of Values.
 - 2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
 - 3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
 - 4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
 - 5. Division 1 Section "Closeout Procedures" for submitting warranties.
 - 6. Divisions 0 through 16 Sections for specific requirements for submittals in those Sections.
- C. The contractor shall execute and submit to the Owner with such promptness to cause no delay in his own work or in the work of others, shop drawings or setting drawings or Conformance Submittals and other forms required for the Work. The Owner shall pass upon the shop drawings or setting drawings with reasonable promptness. The contractor shall make any corrections required and if necessary, resubmit shop drawings or setting drawings for the Owner's approval. Shop drawings, settings drawings or other action submittals required for this work are delineated in the specifications and no substitutions are allowed.
- D. Shop drawings settings and action submittals required for this work are delineated in the specifications (no substitutions) and shall include but are not limited to:
 - 1. Division 2 Civil
 - 2. Division 2 Building
 - 3. Division 3
 - a. Concrete Mix Design (See 03300 or 03310 for submittal Form)
 - b. Steel Reinforcement
 - 4. Division 4
 - 5. Division 5
 - a. Structural Steel
 - b. Steel Joists
 - c. Steel Deck
 - d. Metal Fabrications
 - 6. Division 7
 - a. Sheet Metal Flashing and Trim
 - b. Roof Accessories
 - 7. Division 8
 - a. Steel Doors and Frames
 - b. Flush Wood Doors
 - c. Access Doors, Strip Doors and Traffic Impact Doors
 - d. Door Hardware
 - e. Glazing
 - 8. Division 9
 - a. Paint
 - 9. Division 10
 - a. Toilet Compartments Signs
 - 10. Division 11
 - a. Loading Dock Equipment

- 11. Division 15
 - a. Drinking Fountains and Water Coolers (operation and maintenance data)
- 12. Division 16
 - a. Seismic Controls for Electrical Work
 - b. Panelboards
 - c. Interior Lighting (Modular Wiring Only)
 - d. Exterior Lighting (Poles Only)
- E. Conformance Submittals and other forms required for this work are delineated in the specifications (no substitutions) and shall include, but not be limited to:
 - 1. Division 2 Civil
 - a.)
 - 2. Division 2 Building
 - 3. Division 3
 - a. Admixtures
 - b. Liquid Densifiers and Sealers
 - c. Moisture Retaining Cover
 - d. Semi rigid polyurea joint filler
 - e. Natural aggregate shake hardener (if indicated on drawings)
 - 4. Division 7
 - a. Building Insulation – Faced, Unfaced, and Sound Attenuation Fiberglass Batts
 - b. Elastomeric Single-ply Membrane Roofing (Conformance Submittal)
 - c. Metal Flashing and Trim – Architectural
 - d. Joint Sealants
 - 5. Division 8
 - 6. Division 9
 - a. Interior Walls – Standard
 - b. Interior Walls – Water Resistant
 - c. Acoustical Ceiling Tile (Conformance Submittal)
 - d. Vinyl Cove Base
 - e. Vinyl Composition Floor Tile (If indicated on drawings)
 - 7. Division 10
 - a. Electrical Hand Dryers
 - b. Grab Bars
 - c. Toilet Tissue Holders
 - d. Napkin Disposal
 - e. Horizontal Baby Changing Station
 - f. Metal Framed Mirrors
 - g. Paper Towel Dispenser
 - 8. Division 15
 - a. Duct Insulation
 - b. Pipe Insulation
 - c. Valves
 - d. Fuel Gas Piping
 - e. Plumbing Fixtures
 - f. Plumbing Specialties
 - g. Trench Drain
 - h. Electric, Domestic Water Heaters
 - i. Fuel-Fired Unit Heaters
 - j. Rooftop Air Conditioners
 - k. Energy Recovery Ventilators
 - l. Duct Accessories
 - m. Power Ventilators
 - n. Smoke Exhaust Fans
 - o. Diffusers, Registers and Grilles

9. Division 16
 - a. Basic Electrical materials and Methods
 - b. Grounding and Bonding
 - c. Conductors and Cables
 - d. Control/signal Transmission Media
 - e. Raceways and Boxes
 - f. Cable Trays
 - g. Wiring Devices
 - h. Packaged Engine Generators
 - i. Generator & ATS Start-Up Submittal
 - j. Enclosed Switches and circuit Breakers
 - k. Transfer Switches
 - l. Panelboards
 - m. Dry-Type Transformers (1000 V and Less)
 - n.
 - o.
 - p.
- F. The five sets of Structural Steel shop drawings (Structural Steel, Steel Joists, Steel Deck) shall be addressed to the Architect of Record for review and approval as well as uploaded, in a timely manner to Site|Folio (www.sitefolio.net) The Fire Protection shop drawings (Water Storage Tank, Fire-Suppression Sprinklers, Electric-drive, Horizontal Fire Pumps) shall be addressed to The Lowe's Assigned Fire Protection Consultant as described in Section 13916 for review and approval as well as uploaded, in a timely manner to Site|Folio (www.sitefolio.net) All other submittals and Conformance Submittals shall be uploaded to the Project Folder (under Sub-Folder Project Manager, sub-folder Submittal Information) on Site|Folio (www.sitefolio.net) For those items which require a physical sample to be submitted, said submittals shall be addressed to: Lowe's Project Manager, Engineering & Construction Department, 1000 Lowe's Blvd, Mooresville, NC 28117.
- G. Shop drawings are drawings, diagrams, schedules and other data specially prepared for the work by the contractor or any subcontractor, manufacturer, supplier or distributor to illustrate some portions of the work.
- H. Conformance Submittals are affidavits in which the General Contractor and the Sub-Contractor submit indicating the specified product to be used in the project.
- I. Product data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portions of the Work.
- J. Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the work will be judged.
- 1.03 DEFINITIONS
 - A. Action Submittals: Written and graphic information that requires Owner/Architect's responsive action.
 - B. Informational Submittals: Written information that does not require Owner/Architect's responsive action. Submittals may be rejected for not complying with requirements.
- 1.04 SUBMITTAL PROCEDURES
 - A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Owner reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - B. Submittals Schedule: Comply with requirements in Division 2 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

- C. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
 - 1. Initial Review: Allow 15 business days (unless noted otherwise) for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Owner will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Re-submittal Review: Allow 15 business days for review of each re-submittal.
- D. Identification: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Provide a space approximately 4 by 5 inches (100 by 125 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Owner.
 - 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Contractor.
 - d. Name and address of subcontractor.
 - e. Name and address of supplier.
 - f. Name of manufacturer.
 - g. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Re-submittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
 - j. Location(s) where product is to be installed, as appropriate.
 - k. Other necessary identification.
- E. Deviations: Highlight or otherwise specifically identify deviations from the Contract Documents on submittals.
- F. Additional Copies: Unless additional copies are required for final submittal, and unless Owner observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - 1. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Owner will return submittals, without review, received from sources other than Contractor.
 - 1. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, and installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Use only final submittals with mark indicating action taken by Architect, Engineer, Designer or Owner in connection with construction."

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
 - 1. Number of Copies: Upload one copy for each submittal, unless otherwise indicated. Marked up, rejected and/or approved versions will be maintained on SiteFolio as a Project Record Document. .
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Compliance with specified referenced standards.
 - j. Testing by recognized testing agency.
 - k. Application of testing agency labels and seals.
 - l. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Notation of coordination requirements.
 - j. Notation of dimensions established by field measurement.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 24 by 36 inches (600 by 900 mm).
- D. Coordination Drawings: Comply with requirements in Division 01 Section "Project Management and Coordination".
- E. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed. Prepare physical units of materials or products including the following.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Owner will return submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Owner will retain two Sample sets; remainder will be returned.]
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- F. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product.
 2. Number and name of room or space.
 3. Location within room or space.
 4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Owner will return two copies.
 - a. Mark up and retain one returned copy as a Project Record Document.
- G. Contractor's Construction Schedule: Comply with requirements specified in Division 2 Section "Construction Progress Documentation" for Construction Manager's action.
- H. Delegated Design Submittal: Comply with requirements in Division 2 "Quality Requirements".
- I. Submittals Schedule: Comply with requirements specified in Division 2 Section "Construction Progress Documentation."
- J. Application for Payment: Comply with requirements specified in Division 2 Section "Payment Procedures."
- K. Schedule of Values: Comply with requirements specified in Division 2 Section "Payment Procedures."
- L. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
 4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Owner will return two copies.
 - a. Mark up and retain one returned copy as a Project Record Document.
- M. LEED Submittals: Comply with requirements specified in Division 2 Section "Sustainable Design Requirements."
 1. Upload LEED submittals to Site|Folio (www.sitefolio.net) if store is a LEED project.

2.02 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit one copy of each submittal, unless otherwise indicated. Owner will not return copies.
 2. Upload LEED submittals to Site|Folio (www.sitefolio.net) if store is a LEED project.
 3. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 4. Test and Inspection Reports: Comply with requirements specified in Division 2 Section "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Division 2 Section "Project Management and Coordination."
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
- L. Schedule of Tests and Inspections: Comply with requirements specified in Division 2 Section "Quality Requirements."
- M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

- P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 2 Section "Operation and Maintenance Data."
 - Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
 - R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
 - S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 6. Statement whether conditions, products, and installation will affect warranty.
 - 7. Other required items indicated in individual Specification Sections.
 - T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
 - U. Construction Photographs and Videotapes: Comply with requirements specified in Division 2 Section "Photographic Documentation."
- 2.03 DELEGATED DESIGN
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
 - B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate 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.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect, Engineer, Designer or Owner.
- B. By approving and submitting shop drawings, product data and samples, the Contractor represents that it has determined and verified all materials, field measurements, and field construction criteria related thereto, and that the Contractor has checked and coordinated the information contained within such submittals with the requirements of the work and the contract documents.
- C. The Contractor shall not be relieved of responsibility for any deviation from the requirements of the contract documents by the Architect, Engineer, Designer or Owner's approval of shop drawings, product data or samples under Division 00, paragraph 4 unless the Contractor has specifically informed the Architect, Engineer, Designer or Owner in writing of such deviation at the time of submission and the Architect, Engineer, Designer or Owner has given written approval to the specific deviation. The Contractor shall not be relieved from responsibility from errors or omissions in the shop drawings, product data or samples by the Architect's, Engineer's, Designer's or Owner's approval thereof.
- D. The Contractor shall direct specific attention, in writing or on resubmitted shop drawings, product data or samples, to revisions other than those requested by the Architect, Engineer, Designer or Owner on previous submittals.
- E. No portion of the work requiring submission of a shop drawing, product data or sample shall be commenced until the submittal has been approved by the Owner. All such portions of the work shall be in accordance with approved submittals.
- F. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S, ENGINEER'S, DESIGNER'S OR OWNER'S ACTION

- A. General: Architect, Engineer, Designer, or Owner will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect, Engineer, Designer or Owner will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect, Engineer, Designer or Owner will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. Informational Submittals: Architect, Engineer, Designer or Owner will review each submittal and will not return it, or will return it if it does not comply with requirements. Owner will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

3.03 DOCUMENTS AND SAMPLES AT THE SITE

- A. The contractor shall maintain, for the Architect, Engineer, Designer or Owner, at the construction site one record copy of all drawings, specifications, addenda, change orders and other modifications, in good order and marked currently to record all changes during construction. This set will also include shop drawings, product data and samples. This set shall be available to the Architect, Engineer, Designer or Owner during the course of the work and shall be delivered to the Owner by the contractor upon completion of the work.

END OF SECTION 01330

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SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 2 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections include the following:
 - 1. Division 0 Section "Allowances" for testing and inspecting allowances.
 - 2. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 3. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
 - 4. Divisions 0 through 16 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Owner and Architect.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.04 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Owner for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Owner for a decision before proceeding.

1.05 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of contractor by the contract documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Owner.

1.06 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Delegated-Design Submittal: In addition to shop drawings, product data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- C. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
 - H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
 - I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Owner.
 - 2. Notify Owner seven (7) days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Owner's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven (7) days for initial review and each re-review of each mockup.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Demolish and remove mockups when directed, unless otherwise indicated.
- 1.08 QUALITY CONTROL
- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
 - B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not. All costs for these services shall be as indicated in Division 00 Section 7.7.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
 - C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 2 Section "Submittal Procedures."
 - D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
 - 1. Testing Agency Responsibilities: Cooperate with architect and contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 2. Notify Owner and contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

3. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through contractor.
 5. Do not release, revoke, alter, or increase requirements of the contract documents or approve or accept any portion of the work.
 6. Do not perform any duties of contractor.
- E. Testing Agency Responsibilities: Cooperate with Owner and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Owner and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- 1.09 SPECIAL TESTS AND INSPECTIONS
- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Testing agency will notify Owner and contractor promptly of irregularities and deficiencies observed in the work during performance of its services.
 2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to architect with copy to contractor and to authorities having jurisdiction.
 3. Testing agency will submit a final report of special tests and inspections at substantial completion, which includes a list of unresolved deficiencies.
 4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the contract documents.
 5. Testing agency will retest and reinspect corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Owner's reference during normal working hours.

3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 - 2. Comply with the Contract Document requirements for Division 2 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400

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SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 2 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. The Contractor shall provide all temporary facilities, whether or not listed herein, for the proper conduct of the work in accordance with accepted construction practices and as required by any public authority having jurisdiction at the location of the project.
- C. Related Sections include the following:
 - 1. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
 - 2. Divisions 0 through 16 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
 - 3. Division 2 Section "Termite Control" for pest control.
 - 4. Division 2 Section "Hot Mix Asphalt Paving" for construction and maintenance of asphalt paving for temporary roads and paved areas.
 - 5. Division 2 Section "Erosion and Sediment Control".
 - 6. Division 2 Section "Concrete Pavement Curb and Sidewalk" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.03 DEFINITIONS

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

1.04 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing and inspecting agencies, and authorities having jurisdiction.
- B. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.05 QUALITY ASSURANCE

- A. Electric Service: Comply with ANSI A10.6, NFPA 241, NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.06 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time and when acceptable to Owner, change over from use of temporary service to use of permanent service.
- B. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

- C. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
1. Keep temporary services and facilities clean and neat.
 2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Owner. Provide materials suitable for use as intended.
- B. Pavement: Comply with Section "Hot Mix Asphalt Paving and "Concrete Pavement Curb and Sidewalk"
- C. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.76-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.
- D. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.
- E. Lumber and Plywood: Comply with requirements in Division 06.
- F. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.
- G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- H. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.
- I. Paint: Comply with requirements in Division 09 painting Sections.
- J. Water: Potable.

2.02 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack board.
 3. Drinking water and private toilet.
 4. Coffee machine and supplies.
 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
 6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

2.03 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation or combustion type; vented; fully enclosed with glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water, drinking-water units, including paper cup supply.

- D. Electrical:
 - 1. Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110-V to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
 - 2. Power Distribution: Power distribution system circuits where permitted are to be overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be non-metallic sheathed cable.
- E. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Division 2 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching compatible materials and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements can not be used for that purpose.
- B. Sanitary Sewers: If sanitary sewer is available, provide temporary utilities to remove effluent lawfully. If sanitary sewer is not available or can not be used for the discharge of effluent provide containers to remove and dispose of effluent off-site in a lawful manner.
 - 1. Connect temporary sewers to municipal system or private system indicated and as directed by authorities having jurisdiction.
 - 2. Maintain temporary facilities in a clean, sanitary condition. After heavy use, restore to normal conditions promptly.
- C. Storm Drainage: Comply with EPA, State or Local Construction General Permit for construction stormwater discharges. Assure excessive soil, construction debris, chemicals, oils, and similar contaminants are not discharged to receiving waters.
- D. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Facilities shall be maintained in a clean and hygienic condition and shall remain available for use until the project is accepted by the Owner.
 - 1. Disposable Supplies: Provide and maintain adequate supply of toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for disposal of used materials.
 - 2. Toilets: Install enclosed self-contained toilet units.

3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash-up.
 - a. Supply cleaning compounds appropriate for each type of material handled. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
 4. Drinking Water: Provide bottled drinking water for all site personnel.
- F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
1. General Contractor to provide necessary heat as required for the proper installation of finish materials or as directed by the Owner.
 2. General Contractor is to close all exterior openings until permanent enclosures are in place while the building is being heated or cooled.
 3. Maintain a minimum temperature of 50 deg F (10 deg C) in permanently enclosed portions of building for normal construction activities, and 65 deg F (18.3 deg C) for finishing activities and areas where finished work has been installed.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- H. Electric Power Service: Provide and maintain electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations for the duration of the work.
1. Install in accordance with the requirements of the local power company and all local laws, ordinances and regulations.
 2. Install weatherproof, grounded electric power service and distribution system service of sufficient size, capacity, and power characteristics during the Construction period.
 3. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
 4. Install electric power service underground, unless otherwise indicated.
 5. Install distribution wiring overhead and rise vertically where least exposed to damage.
 6. Provide receptacle outlets adequate for connection of power tools and equipment. Use waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach area where construction activities are in progress. Do not exceed safe length-voltage ratio.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Provide one (1) 100-W incandescent lamp per 500 sq. ft. (45 sq. m), uniformly distributed, for general lighting, or equivalent illumination.
 3. Provide one (1) 100-W incandescent lamp every 50 feet (15 m) in traffic areas or equivalent illumination.
 4. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
 5. Install lighting for Project identification sign.
- J. Telephone Service: Provide temporary telephone service throughout construction period in common-use facilities for use by all construction personnel. The General Contractor shall provide and pay for telephone and facsimile on the site during the complete job. Telephone and facsimile shall be kept in operation until Owner has secured at least one temporary telephone within the building. The Owner will be notified in writing of the telephone and facsimile numbers as soon as practical after they have been installed..
1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.

- b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
 - K. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.
- 3.03 SUPPORT FACILITIES INSTALLATION
- A. General: Comply with the following:
 - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 - 2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
 - 3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
 - B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations as indicated on the drawings. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare sub grade and install sub base and base for temporary roads and paved areas according to Division 2 Section "Earthwork."
 - 3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 2 Section "Hot Mix Asphalt Paving."
 - C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
 - D. Parking: Provide temporary parking areas for construction personnel. Temporary parking areas used for construction activities are considered part of the regulated stormwater pollution prevention area and shall be treated as such.
 - E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
 - F. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
 - 1. Provide temporary, directional signs for construction personnel and visitors.
 - 2. Maintain and touchup signs so they are legible at all times.
 - G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize, separate and clearly label hazardous, dangerous or unsanitary waste materials. Comply with requirements of authorities having jurisdiction. Comply with Lowe's Development and Design Criteria Stormwater Pollution Prevention Program Section 800.
 - 1. If required by authorities having jurisdiction, provide separate clearly labeled containers for each type of material.

2. Develop a waste management plan for Work performed on the Project. Indicate types of waste materials the Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 1. Comply with work restrictions specified in Division 2 Section "Summary."
- B. Protection of Work and Property: The Contractor shall be responsible for the entire site and building and shall provide all necessary protections as required by Owner and by laws, ordinances and codes governing such conditions. The Contractor and its employees are responsible for any damage to the Owner's property or other's property and shall pay for any claims against the Owner.
 1. No fires of any kind will be allowed inside or around the operation during the course of construction without special permission of the Owner.
- C. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 2 Section "Erosion and Sediment Control."
 1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and sub grade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Vertical Openings: Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
 3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
- H. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.
 1. Construct dustproof partitions with not less than nominal 4-inch (100 mm) studs, 5/8-inch (16 mm) gypsum wallboard with joints taped on occupied side, and ½ inch (13 mm) fire-retardant walls. Cover floor with ¾ inch (19 mm) fire-retardant plywood.
 2. Construct dustproof floor-to-ceiling partitions with not less than nominal 4-inch (100 mm) studs, with 2 layers of 3-mil (0.07-mm) polyethylene sheet on each side. Cover floor with 2 layers of 3-mil (0.07-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
 3. Insulate partitions to provide noise protection to occupied areas.
 4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 5. Protect air-handling equipment.
 6. Weather strip openings.

- I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Store combustible materials in containers in fire-safe locations.
 4. Provide fire extinguishers, installed on walls with mounting brackets, visible and accessible from space being served with sign mounted above.
 - a. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell or and exit.
 - b. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting.
 5. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 6. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
 7. Complete installation and begin use of permanent fire protection facility including connected services at earliest feasible date in each area of Project. Instruct key personnel on use of facilities.
- 3.05 OPERATION, TERMINATION, AND REMOVAL
- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
 - B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
 - C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
 - D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01500

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SECTION 01731 - CUTTING AND PATCHING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. See Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
- C. Requirements in this Section apply to mechanical and electrical installations. See Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.
- D. The contractor shall be responsible for all cutting, fitting or patching that may be required to complete the work or to make its several parts fit together properly.
- E. The contractor shall not damage or endanger any portion of the work or the work of the Owner or any separate contractors by cutting, patching or otherwise altering any work, or by excavation. The contractor shall not cut or otherwise alter the work of the Owner or any separate contractor except with the written consent of the Owner and of such separate contractor. The contractor shall not unreasonably withhold from the Owner or any separate contractor his consent to cutting or otherwise altering the work.

1.03 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
 - 6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - 7. Owner Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.04 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Owner or Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

1.05 WARRANTY

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

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.03 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 01731

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SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Sections:
 - 1. Division 01 Section "Project Management and Coordination" for coordination of responsibilities for waste management.
 - 2. Division 02 Section "Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements and for disposition of hazardous waste.
 - 3. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.
 - 4. Division 04 Section "Stone or Face Brick Masonry" for disposal requirements for excess stone and stone waste.
 - 5. Division 02 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

- A. Clean: Untreated and unpainted, not contaminated with oils, solvents, caulk, paint or other pollutants.
- B. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- C. Comingled: Collecting all material types into a single bin or mixed collection and separating waste materials into recyclable material types at an off-site location.
- D. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- E. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

- F. 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 recycled.
- G. Hazardous: Exhibiting the characteristics of hazard substances (i.e., ignitability, corrosiveness, toxicity or reactivity).
- H. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- I. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere if possible.
- J. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- K. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- L. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste
- M. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- N. Waste Management Coordinator: The General Contractor Superintendent will manage site wastes and surplus under the requirements outlined in the Construction Waste Management Plan.
- O. Construction Waste Management Plan: Construction and/or demolition wastes shall be identified and incorporated into a Construction Waste Management Plan (CWMP) The CWMP will include an analysis of wastes to be generated, including the types of recyclable and waste materials generated by weight or volume created by constructing the project. The completed CWMP must be completed and submitted to Lowe's prior to commencement of construction. The CWMP will be discussed at a Construction Waste Pre-construction Meeting.
- P. Waste Recovery Progress Reports: Report that must be submitted with the Monthly Pay Application that shows the amount of items that were recycled that period.
- Q. Waste Recovery Progress Report back up: Submit manifests, weight tickets, receipts and invoices identifying the project and construction wastes.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of [50] [75] (*indicate which*) percent by weight or volume of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:

- a. Asphaltic concrete paving.
- b. Concrete.
- c. Concrete reinforcing steel.
- d. Brick.
- e. Concrete masonry units.
- f. Wood studs.
- g. Wood joists.
- h. Plywood and oriented strand board.
- i. Wood paneling.
- j. Wood trim.
- k. Structural and miscellaneous steel.
- l. Rough hardware.
- m. Roofing.
- n. Insulation.
- o. Metal studs.
- p. Gypsum board.
- q. Carpet.
- r. Carpet pad.
- s. Demountable partitions.
- t. Equipment.
- u. Cabinets.
- v. Piping.
- w. Supports and hangers.
- x. Valves.
- y. Mechanical equipment.
- z. Refrigerants.
- aa. Electrical conduit.
- bb. Copper wiring.
- cc. Switchgear and panel boards.
- dd. Transformers.(only non-hazardous)

2. Construction Waste:

- a. Concrete waste.
- b. Masonry and CMU.
- c. Lumber.
- d. Wood sheet materials.
- e. Wood trim.
- f. Metals.
- g. Roofing.
- h. Insulation.
- i. Metal studs.
- j. Gypsum board.
- k. Piping.
- l. Electrical conduit and Wire.
- m. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

- 1) Paper.
- 2) Cardboard.
- 3) Boxes.
- 4) Plastic sheet and film.
- 5) Polystyrene packaging.
- 6) Wood crates.
- 7) Plastic pails.

1.5 ACTION SUBMITTALS

- A. Construction Waste Management Plan: Submit Construction Waste Management Plan (CWMP) along with Waste Identification Worksheets within 14 days of date established from Notice to Proceed. The CWMP must be approved by Lowe's prior to the start of work. Use Forms CWM-1 and CWM-2 to prepare the waste identification information and Form CWMP – 1 for the actual C.

1.6 INFORMATIONAL SUBMITTALS

- A. Monthly Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report with back up information. Use Form CWM-7 to document construction waste progress and Form CWM-8 for demolition waste progress. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in cubic yards or **tons**.
4. Quantity of waste salvaged, in cubic yards or **tons**.
5. Quantity of waste recycled, in cubic yards or **tons**.
6. Total quantity of waste recovered (salvaged plus recycled) in cubic yards or **tons**.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

Note: waste reduction progress reports must submit quantities in either weight (tons) or volume (cubic yards) but must be consistent throughout.

- B. Total Project Waste Reduction Calculations: Before requesting Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work. Use Forms CWM-3 and/or CWM-4.
- C. Total Project Cost/Revenue Analysis: Before requesting Substantial Completion, submit calculated Total Project Cost/Revenue Analysis using Forms CWM-4 and/or CWM-5.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal: Complete LEED letter template for Credit MR 2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- H. Qualification Data: For Site Superintendent with Waste Management Experience and Refrigerant Recovery Technician.
- I. 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.

1.7 QUALITY ASSURANCE

- A. Waste Management: General Contractor Superintendent shall manage construction and demolition waste (if applicable) per this specification. The Superintendent shall have a record of successful waste management coordination of Projects with similar requirements.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction. Also review the Project SWPPP (Section 800) for additional requirements.
- D. Preconstruction Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Project Superintendent.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation (if separated on site) and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a Construction Waste Management Plan (CWMP) according to ASTM E 1609 and requirements of this Section. The CWMP shall consist of waste identification, construction waste management plan, waste reduction progress reports, cost/revenue analysis, and a summary of total project waste reduction.. Identify construction and/or demolition waste.

Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

- B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste]. Include estimated quantities and assumptions for estimates.
- C. Total Project Waste Reduction: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to salvage contractors, include list of their names, addresses, and telephone numbers.
 - 3. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:
 - 1. Total quantity of waste in volume or weight.
 - 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 - 3. Total cost of disposal (with no waste management).
 - 4. Revenue from salvaged materials.
 - 5. Revenue from recycled materials.
 - 6. Savings in hauling and tipping fees by donating materials.
 - 7. Savings in hauling and tipping fees that are avoided.
 - 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 - 9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement CWMP. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Project Superintendent will be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Preconstruction Meeting: General Contractor Superintendent will review the CWMP with workers, subcontractors, and suppliers regarding proper waste management procedures, as appropriate before beginning work at the Project site. The Superintendent shall:
 - 1. Distribute a copy of the approved Construction Waste Management Plan to everyone concerned within 7 days in advance of the preconstruction meeting.
 - 2. Distribute the CWMP to everyone concerned anytime revisions are made.
 - 3. Review entire plan content, procedures and locations established for salvage, storage, recycling, and disposal.
- D. Monthly Meetings: The Superintendent shall hold regularly scheduled monthly meetings to discuss project schedule and progress of any waste items on site.
- E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, and donated.
 - 2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
 - 3. Comply with Lowe's Stormwater Pollution Prevention Plan requirements per Development and Design Criteria Section 800.
 - 4. Comply with Division 02 Section 02020 Erosion and Sediment Control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 - 1. Washed stone for temporary drives
 - 2. Crushed concrete and masonry for site fill..
- B. Salvaged Items for Sale are **not permitted** on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area and covered if needed until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: Include listing of all recycling activities for source separated or mixed material recycling centers where recycling will occur including all recycling receivers and processors in the CWMP.

C. Construction Waste Reduction Incentives: Revenues, savings rebates, tax credits, and other incentives received for recycling waste materials shall be Lowe's 60% / General Contractor 40 %. Total revenues, savings, rebates, tax credits and other incentives shall be calculated using Forms CWM-5 and CWM-6 only as reviewed and accepted by Lowe's.

D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

E. The following sorting methods are acceptable:

1. Sorting recyclable materials at the Project site and transporting them to recycling markets directly from the Project site, or;
2. Employing haulers who make use of a materials-recovery facility or transfer station where recyclable materials are sorted from the waste and recycled before disposing of the remainder. If using a hauler or recycling facility to sort out recyclables, verify that the hauler sorts out all construction waste loads and is not limited to those that are not acceptable at the landfill. Also, verify that the hauler or recycling facility recycles at least three types of materials.

F. Procedures for sorting recyclable materials at the Project site: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - b. All signage a minimum of 24" X 36" (6 SF) with 3" minimum high lettering.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and

protect from rain, ice, and snow. Reference Lowe's Stormwater Pollution Prevention Plan.

3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor per requirement specified in the Waste Management Plan.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphaltic Concrete Paving: Grind or break up asphalt to size required to meet applicable requirements of authority having jurisdiction and State Department of Transportation. Transport asphalt to be recycled to asphalt-recycling facility.
 1. Reference Section 02741 Hot Mix Asphalt Paving for Reclaimed Asphalt Pavement (RAP). Final RAP mix shall be free of contamination including dirt, debris, concrete, clean stone and other impurities.
 2. Bituminous concrete may be reused under and immediately below the pavement as a base course if so indicated and approved by the geotechnical engineer and Owner.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 1. Pulverize concrete to maximum 1 ½" (38 mm) diameter or size indicated on the drawings.
 2. Crush concrete and screen to comply with requirements in Division 02 "Earthwork" for use as satisfactory soil for fill or subbase. Gradation, plasticity, soundness, and abrasion requirements of the material shall meet the governing Department of Transportation specifications for recycled concrete aggregate or aggregate base course. Recycled aggregate may not include foreign materials including reinforcing steel, wood or other friable material. Approval of the use of recycled concrete aggregate shall only be authorized in writing by the Owner.
- C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 1. Pulverize masonry to maximum 1 ½" (38 mm) diameter or size indicated on the drawings.
 2. Crush concrete and screen to comply with requirements in Division 02 "Earthwork" for use as satisfactory soil for fill or subbase. Gradation, plasticity, soundness, and abrasion requirements of the material shall meet the governing Department of Transportation specifications for recycled concrete aggregate or aggregate base course.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. Metals: Separate metals by type.
 1. Structural Steel: Stack members according to size, type of member, and length.
 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- J. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- L. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
 - 1. Comply with requirements in Division 02 Section 02920 "Landscaping" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Division 02 Section 02920 "Landscaping" for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Division 02 Section 02920 "Landscaping" for use of clean ground gypsum board as inorganic soil amendment.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

3.7 ATTACHMENTS

- A. Form CWMP-1 Construction Waste Management Plan
- B. Form CWM-1 Construction Waste Identification Worksheet
- C. Form CWM-2 Demolition Waste Identification Worksheet
- D. Form CWM-3 Construction Waste Reduction Monthly Progress Report
- E. Form CWM-4 Demolition Waste Reduction Monthly Progress Report
- F. Form CWM-5 Cost/Revenue Analysis of Construction Waste Reduction For Project
- G. Form CWM-6 Cost/Revenue Analysis of Demolition Waste Reduction For Project
- H. Form CWM-7 Total Project Construction Waste Reduction
- I. Form CWM-8 Total Project Demolition Waste Reduction

END OF SECTION 017419

SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 2 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project Record Documents
 - 3. Subcontractor Information Form (see attached)
 - 4. Operations and Maintenance Manuals
 - 5. Warranties.
 - 6. Instruction of Owner's personnel
 - 7. Final cleaning.
- B. Related Sections include the following:
 - 1. Division 0 Section "Applications for payment for construction completion and final acceptance. (Forthcoming "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.)
 - 2. Division 01 Section "Construction Progress Documentation".
 - 3. Divisions 0 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Shall have obtained the Certificate of Occupancy or equivalent approval as required by local and/or state authorities.
 - 2. Shall have thoroughly cleaned the building and made it ready in all respects for occupancy and use by the Owner.
 - 3. Shall contact the Owner and arrange for persons designated by him to be instructed in the location, function, operational and routine maintenance of all building systems including:
 - a. Heating and air conditioning equipment.
 - b. Electrical panels, switches and apparatus.
 - c. Sprinkler system.
 - d. Plumbing equipment.
 - e. Sewage disposal system.
 - 4. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 5. Advise Owner of pending insurance changeover requirements.
 - 6. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 7. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 8. Prepare and submit Project Record Documents, operation and maintenance manuals, Subcontractor Information Form, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 9. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 10. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 11. Complete startup testing of systems.
 - 12. Submit test/adjust/balance records.

13. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 14. Advise Owner of changeover in heat and other utilities.
 15. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 16. Complete final cleaning requirements, including touchup painting and make ready in all respects for occupancy.
 17. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Owner will either proceed with inspection or notify Contractor of unfulfilled requirements. Owner/Architect may prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Owner/Architect, that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.
- 1.04 FINAL COMPLETION
- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 0
 2. Submit certified copy of Owner/Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Owner/Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- 1.05 LIST OF INCOMPLETE ITEMS (PUNCH LIST)
- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Construction Manager.
 - d. Name of Contractor.
 - e. Page number.
- 1.06 KEY TURNOVER SUBMITTALS
- A. Submit complete copies of the following to the Lowe's Store Manager on the date of Key Turnover and upload to Site|Folio under the applicable project folder. Submit the following:
1. Two (2) copies of all installation, operating, and maintenance instructions, parts lists, and manufacturer's literature on equipment and materials furnished under this contract, each of the two (2) sets bound in separate black vinyl 3-ring binders. Each binder shall be labeled to indicate the project name and name of contractor. Sections specifically included shall be: 1) Plumbing, 2) Electrical, 3) Mechanical, 4) Sprinkler, and 5) Prefinished Metal Roofing.
 2. Two (2) copies of all warranties and guarantees required under this contract, identified as to name of project and date of final acceptance. Reference "A02 Warranty Summary Sheet" for a complete list of ALL asset warranties and their terms (years).

Examples of asset warranty terms to capture include, but not limited to:

- a) Wood Doors Warranty – (Life of Installation)
 - b) Manual Door Closure Warranty – Ten (10) Years
 - c) Skylights Manufacturer Warranty – Five (5) Years
 - d) Fire Systems Controller Warranty – One (1) Year
 - e) Storefront Aluminum Entrance Warranty – Two (2) years
 - f) Storefront Coated Glass Manufacturer Warranty – Five (5) years
 - g) Insulating Glass Manufacturer Warranty - Ten (10) years
 - h) HVAC Compressor Warranty - Ten (10) years
 - i) Water Cooler Sealed Refrigeration System - Four (4) years
 - j) Water Heater Tank Warranty - Three (3) years
 - k) Mirrors (silver spoilage) Warranty - Fifteen (15) years
 - l) Roofing Systems Total Warranty - Twenty (20) years
 - m) Termite Control Guarantee - Five (5) years
 - n) EIFS System Warranty - Six (6) years
 - o) Exterior Wall Coating Warranty - Ten (10) years
 - p) Pre-finished Metal Roofing Warranty - Twenty (20) years
 - q) Interior Slab Curing Material Warranty - Twenty (20) years
 - r) Acoustical Ceiling Warranty - One (1) year
 - s) Generator Warranty - Seven (7) years
 - t) Hydraulic/Pneumatic Pit Leveler Warranty - Five (5) years
 - u) Interior LED Lighting - Ten (10) years
3. Two (2) typed copies listing all subcontractors employed on the work showing names, addresses, telephone numbers, respective trade and products provided.
 4. All keys to the building remaining in the Contractor's possession.
 5. One (1) copy of the general construction drawings, clearly marked to indicate all changes made during the course of construction, and identified as “As-Built” Drawings (stapled sets rolled and bound with rubber bands).
 6. Two (2) copies of generator set start-up information, including make, model and serial number including the make, model and serial number for the transfer switches.
 7. Two (2) copies of the generator set fuel tank information, including size, make, and serial number.
 8. Two (2) copies of the fire pump transfer switch (if installed) information, including make model and serial number.
 9. One (1) white bond paper copy and an electronic pdf copy upload to Site Folio “As-Built” shop drawings, two (2) copies of the hydraulic calculations and two (2) copies of the manufacturer’s descriptive literature as specified in Section 13916, are to be distributed as follows:
 - a. One (1) white bond paper copy of the sprinkler system “As-Built” shop drawings, hydraulic calculations and manufacturer’s descriptive literature shall be included in the “Project Close-out Documents” set designated as the Store’s copy.
 - b. Electronic format (AutoCAD) of the sprinkler system “As-Built” shop drawings, hydraulic calculations and manufacturer’s descriptive literature shall be included in the “Project Close-out Documents” set designated as Lowe’s copy, uploaded to Site Folio.
 10. All punch list items complete.
 11. Two (2) copies of water sterilization tests.
 12. Two (2) copies of the Contractor's Material and Test Certificate for Aboveground and Underground Piping.
 13. Two (2) copies each of any subsequent sprinkler system inspections or test reports required by the Authorities Having Jurisdiction.

14. Letter certifying that store manager has been instructed in the location, function, operation, and routine maintenance of all building systems including:
 - a. Heating & Air Conditioning Equipment.
 - b. Electrical Panels, Switches and Apparatus.
 - c. Sprinkler System.
 - d. Plumbing Equipment.
 - e. Sewage Disposal System.
15. Registered letters requesting each:
 - a. Construction Completion Inspection.
 - b. Final Inspection and Acceptance.
16. Two (2) copies certifying that sanitary sewer system has been tested and approved.
17. HVAC System Start-Up Supervision Verification Forms.
18. Written Structural Analysis Certified by a Registered Professional Engineer for Shade Structures.
19. Construction Completion shall be defined as all aspects of work being complete, including punch lists.
20. Upon verification of Construction Completion the Contractor shall initiate procedures to terminate his building insurance by first giving the Owner at least seven days written notice of the date and time at which termination will occur. Upon termination the Owner will assume insurance responsibility for the buildings and its contents. The Contractor's liability insurance shall remain in force until Final Acceptance.
21. On the Date of Construction Completion the Owner will assume responsibility for all permanent utilities.
22. On the date of Construction Completion, an inspection will be made by Owner's representative and if the Work is found to be fully and satisfactorily complete written notice will be given to the Contractor and the date so established shall be the Date of Construction Completion. The Date of Construction Completion shall be the commencement date of all equipment and material warranties, actual installation date notwithstanding, as well as the Contractor's general warranty. The owner reserves the right to withhold final payment plus any outstanding retainage until the operating and maintenance manuals and warranties described in Items "1.06 A. 1 and 2" above are received by Owner.
23. Prior to Construction Completion, the Owner's Store Set-Up Crew may occupy the sales floor to begin installation of furnishings and equipment.
24. Prior to Final Acceptance and Application for Payment of outstanding retainage, the Contractor shall forward all Closeout Documents to the Owner, including:
 - a. One (1) copy of the Final Project Cost Review Binder. (Negotiated Projects Only)
 - b. Two (2) executed copies of "Contractor's Affidavit of Payment of Debts and Claims" (AIA, G706).
 - c. Two (2) executed copies of "Consent of Surety" (AIA, G707).
 - d. Two (2) executed copies of "Full Unconditional Waiver of Lien" (Standard Form as provided within the Supplemental Instructions to Bidders).
 - e. Two (2) copies of each of the following "Full Unconditional Waiver of Lien" (Standard Form as provided within the Supplemental Instructions to Bidders) from the listed subcontractors:
 - 1) Grading
 - 2) Storefront
 - 3) Acoustical Ceiling
 - 4) Painting
 - 5) Plumbing
 - 6) Mechanical
 - 7) Sprinkler
 - 8) Electrical
 - 9) Concrete
 - 10) Storm Drainage
 - 11) Fencing
 - 12) Landscape
 - 13) Landscape Irrigation
 - 14) Paving
 - 15) Masonry

- 16) Automatic Entrance Systems
 - 17) Insulation
 - 18) Doors and Millwork
 - 19) Roll-Up Doors
 - 20) Ceramic Tile
 - 21) Structural Steel Joists, Columns and Deck
 - 22) Steel Erector
 - 23) Roofing
 - 24) Greenhouse / Shade Structure System
 - f. Any Outstanding:
 - 1) Job Logs
 - 2) Compaction Tests
 - 3) Concrete Tests
 - g. Subcontractor Information Form (see attached)
- 1.07 FINAL PROJECT COST REVIEW BINDER (NEGOTIATED PROJECTS ONLY)
- A. Assemble and prepare a complete project cost/accounting binder in accordance with Contract Terms & Conditions, including but not necessarily limited to;
 - 1. Summary Spread sheet listing all applicable contract cost line items, indicating Owner contract value and accounting for Owner change orders and actual costs to Contractor. Summary Sheet shall indicate proposed project savings for all cost line items, as well as cumulative sum of entire project savings.
 - 2. Contractor's final job cost report
 - 3. Copies of actual subcontracts, purchase orders, subcontractor change orders and other subcontractor related back up information and documentation.
 - 4. Copies of applicable back up information and documentation of general contractor's costs.
 - 5. Itemized account of any/all requests for exemption and/or exception to reduction in project savings, including back up information and documentation.
- 1.08 PROJECT RECORD DOCUMENTS
- A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Owner's/ Architect's reference during normal working hours.
 - B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
 - 1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - 3. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
 - 4. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
 - C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including product options selected.
 3. Note related Change Orders and Record Drawings, where applicable.
- D. Miscellaneous Record Submittals: 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.
- E. All Documentation contained within the final accepted Lowe's National Stormwater Pollution Prevention Program Ledger transferred into electronic format (.doc/.xls/.pdf) and uploaded to Site Folio project SWPPP folder.
1. Archive of records in optically scanned format as a .pdf.
 2. All NOI's, NOC's (notice of coverage - permit certificates), NOT's, and written records required by the General Permit to the Operator for archiving in both paper and .pdf formats.
 3. Actual paper copy of NOT submittal and approval and executed Form F-1 with pdf scanned and uploaded to Site Folio.
 4. Some or all of these documents when determined to be complete by the Lowe's Project Manager may alternatively be submitted on the SWPPP project folder on Site Folio.
- F. Detention/Retention Ponds and Storm Drainage: The Contractor shall provide an As-Built survey of all constructed detention/retention ponds and associated drainage structures prior to final acceptance. The As-Built Survey shall include a written certification verifying the constructed pond volume and inverts of the proposed drainage structures meet or exceed design volume and stormwater intent.
- 1.09 OPERATION AND MAINTENANCE MANUALS
- A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
1. Operation Data: Include emergency instructions and procedures, system and equipment descriptions, operating procedures, and sequence of operations.
 2. Maintenance Data: Include manufacturer's information, list of spare parts, maintenance procedures, maintenance and service schedules for preventive and routine maintenance, and copies of warranties and bonds.
- B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents to be provided for the physical facility, with .pdf copies for full binders uploaded to the project closeout folders in Site Folio.
- 1.10 WARRANTIES
- A. Submittal Time: Submit written warranties on request of Owner/Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual. For the Store Manager's Copy:
1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals and for uploading to Site|Folio as specified.

PART 2 - PRODUCTS

2.01 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

3.01 DEMONSTRATION AND TRAINING

- A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Provide instructors experienced in operation and maintenance procedures.
 - 2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
 - 3. Schedule training with Owner, with at least seven days' advance notice.
 - 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
- B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline.
 - 1. Include instruction for system design and operational philosophy, review of documentation, operations, adjustments, troubleshooting, maintenance, and repair.

3.02 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

- m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Replace parts subject to unusual operating conditions.
 - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - q. Clean light fixtures and reflectors to function with full efficiency. Replace damaged LEDs, fixtures and defective drivers to comply with requirements for new fixtures.
 - r. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

STORE NAME: _____

GENERAL CONTRACTOR: _____

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>INSTALLER</u>
03300 CAST-IN-PLACE CONCRETE-LIQUID DENSIFIER AND SEALER	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ PRODUCT NAME: _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____
07210 BUILDING INSULATION FOAM FILLED INSULATION AND FINISH SYSTEM	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____
07241 EXTERIOR INSULATION AND FINISH SYSTEM	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ PRODUCT NAME: _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____
07411 MANUFACTURED ROOF PANELS	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ PRODUCT NAME: _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____
07531 MEMBRANE ROOFING WARRANTY NO: _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ PRODUCT NAME: _____ MEMBRANE COLOR: _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>INSTALLER</u>
07810 PLASTIC UNIT SKYLIGHTS	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ MODEL NO. _____ _____	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____
08110 STEEL DOORS AND FRAMES	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____
08211 FLUSH WOOD DOORS	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____
08331 OVERHEAD COILING DOORS	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____
08361 SECTIONAL OVERHEAD DOORS (if applicable)	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ _____ PHONE: _____ CONTACT: _____ _____

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>INSTALLER</u>
08410 ALUMINUM ENTRANCES AND STOREFRONTS	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
08461 SLIDING AUTOMATIC ENTRANCE DOORS	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
09911 PAINTING – EXTERIOR MASONRY WATERPROOFING SYSTEM	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
10155 TOILET COMPARTMENTS	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
10801 TOILET AND BATH ACCESSORIES	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
11160 LOADING DOCK EQUIPMENT	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>INSTALLER</u>
13123 GREENHOUSE/ SHADE STRUCTURE	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
13220 WATER STORAGE TANK	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
13921 ELECTRIC- DRIVE HORIZONTAL FIRE PUMPS	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ MODEL NO. _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
15410 PLUMBING FIXTURES	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
15415 DRINKING FOUNTAINS	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>INSTALLER</u>
16231 PACKAGED ENGINE GENERATORS	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ MODEL NO. _____ SERIAL NO. _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
16231 PACKAGED ENGINE GENERATORS – AUTOMATIC TRANSFER SWITCH	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ MODEL NO. _____ SERIAL NO. _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
16415 TRANSFER SWITCHES	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ MODEL NO. _____ SERIAL NO. _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
16511 INTERIOR LIGHTING	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____
16521 EXTERIOR LIGHTING	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____	NAME: _____ ADDRESS: _____ _____ PHONE: _____ CONTACT: _____ _____

ITEM

MANUFACTURER

INSTALLER

OTHERS:

NAME:

ADDRESS:

PHONE:

CONTACT:

NAME:

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PHONE:

CONTACT:

OTHERS:

NAME:

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PHONE:

CONTACT:

SECTION 03130 REPAIR OF EXISTING CONCRETE**PART ONE - GENERAL****1.01 RELATED DOCUMENTS****1.02 SUMMARY**

- A. Concrete slab repair scope includes:
1. Removal of all existing floor finishes (sealers, coatings, tile, etc.), as necessary.
 2. Surface defect repair, including pop-outs, chips, spalls, and pitting.
 3. Joint filler removal and replacement, including joint edge spall repair.
 4. Crack repair.
 5. Removal and replacement of previously completed repairs not in compliance with this section (03130 Repair of Existing Concrete).
 6. Exterior slabs include the Garden Center, Bull Pen, and front sidewalk.

1.03 SUBMITTALS

- A. Contractor shall upload completed submittal package to SAM or Site Folio depending on direction from the Lowe's Representative. Submittal package to include but not limited to:
1. Manufacturer and model of equipment to be used, including types of grinding heads, saws and dust extraction systems for joint filler replacement and slab defect repairs.
 2. Technical data sheets and MSDS sheets required for concrete slab repair materials.

1.04 WARRANTIES

- A. Manufacturer's Warranties
1. Contractors applying the specified joint filler shall provide a manufacturer's warranty for installed joint filler to the Owner, signed by an officer of the manufacturing company.
 2. All invoices for delivered product shall be submitted, as applicable, for warranty validation to the following:
 - a. The Euclid Chemical Company: Phil Brandt - pbrandt@euclidchemical.com
 - b. CTS Cement: Joe Zingale – jzingale@ctscement.com
 - c. The Metzger/McGuire Company: Mike Tuccelli – mike@metzgermcguire.com

1.05 QUALITY ASSURANCE

- A. General:
1. All work is to be completed outside regular store business hours and coordinated with Authorized Store Personnel.
 2. Materials shall be delivered to store in original, factory sealed, unopened, new containers bearing specified manufacturer's name and label.
 3. It is the Contractor's responsibility to store all materials in a secure manner to prevent puncture, damage or turnover in a well-ventilated area at temperatures between 40 and 90 degrees F, unless otherwise noted from manufacturer.
 4. Contractor shall not use any store owned equipment for construction or cleanup, including but not limited to floor scrubber. Contractor should consider Lowe's as a source to purchase products, hand tools, etc. when doing so provides cost savings and benefits to Lowe's.
 5. Store Manager will be responsible for moving store merchandise and will discontinue floor-scrubbing activity 24-hours prior to the start of slab repair work and 24 hours after completion of the slab work.
 6. Contractor must have all equipment and materials removed from the sales floor after the completion of each night's work to ensure that the floor will be ready for unrestricted foot traffic before the store opens the next day.
 7. All excess material must be removed from the store immediately after project completion.
 8. All materials used for repair work must be VOC compliant in accordance with all local jurisdiction requirements. MSDS and technical data sheets must be on file at the store location and with Lowe's Representative for all materials used prior to start of work. All materials, including cleaners must be biodegradable and not contain or emit harsh odor.

9. Contractor must have approval from authority having jurisdiction before disposing of any material. Disposal of any type of material down a storm sewer drain is prohibited.
10. Contractor must follow all OSHA requirements.
11. All sawing or grinding equipment must have an attached shroud and hose connected to a HEPA dust vacuum system as designed and approved by the equipment manufacturer and requirements noted in 2.2 Equipment.
12. Contractor is responsible for obtaining any required building or other permit designated by the authority having jurisdiction.
13. Contractor must conduct a safety meeting the first night of production with all present Lowe's employees. Repair procedures, including information on how the HEPA dust filters on the machines work, will be discussed and location of MSDS sheets identified. The Contractor shall include procedures and information on all power equipment associated with the slab work, including, but not limited to grinding equipment, repair equipment, generator and associated power cords. It is the responsibility of the Contractor to communicate safety hazards with store personnel and provide adequate protection and marking for power cord(s) associated with the repair equipment.
14. Contractor must limit and control all noise, dust, and moisture created by concrete surface restoration work to meet all local, state, and Federal ordinances, codes, and laws. All costs for barricades, protective drapes, and other incidental items necessary to meet the requirements will be provided by the Contractor.

PART TWO - PRODUCTS

2.01 Materials

- A. Contractors performing the work specified herein shall be approved by the product Manufacturer. Contractor shall match filler and sealant color with adjacent concrete color.

2.02 Equipment

- A. Subject to compliance with project requirements, provide equipment manufactured by the following:
 1. HTC (877) 482-8700, www.htc-america.com
 2. Joe Due Blades and Equipment, (877) 563-3833 www.joedue.com
 3. Pullman-Ermator (855) 736-2869 www.pullman-ermator.com
 4. SASE Company, Inc. Knoxville, TN (800) 522-2606 www.sasecompany.com
 5. U.S. Saws, Santa Ana, CA (866) 987-7297 www.ussaws.com
 6. VMC Technical Assistance Corp. (800) 460-4862 www.vmctac.com
 7. Diamatic USA San Diego, CA 866-295-5512 www.diamaticusa.com
- B. Acceptable equipment power
 1. Electric
 - a. All electrical supply shall be provided by the Contractor.
 - b. All fuel powered generators must be used outside the building and in compliance with all authorities having jurisdiction.
 - c. All electrical cables within the store must be clearly identified and coordinated with Authorized Store Personnel on a nightly basis.
 - d. Coordinate security with Store Manager at all access points where cables enter the store.
 2. Propane
 - a. All propane powered equipment must have an emissions scrubber or catalytic muffler.
 - b. The Contractor shall conduct tests twice a month of ambient air with a "Data-Logger" designed to read and log the carbon monoxide in ppm (parts per million) at 1 (one) minute intervals with a range of 0 to 1000 ppm. Air sampling should be done in the "breathing range" of the operator and recorded on a log that is attached to each propane powered machine at all times. Each test session shall be no less than 15 minutes in length and done while operating the propane powered machine during a routine work period. If any readings of ambient air carbon monoxide measure greater than 40 ppm at any time it will be necessary to discontinue the use of the propane powered machine until it has been properly serviced and certified as

meeting these emission requirements. Record of logged test results shall be attached to each individual propane powered machine at all times.

- c. Gas- or diesel-powered equipment is not allowed inside the store.
- d. Vacuum system for grinding and sawing.
- e. HEPA filtered vacuum, designed for use with all hand tools when grinding or sawing concrete (minimum 125CFM air flow).

PART THREE - CONCRETE FLOOR REPAIRS

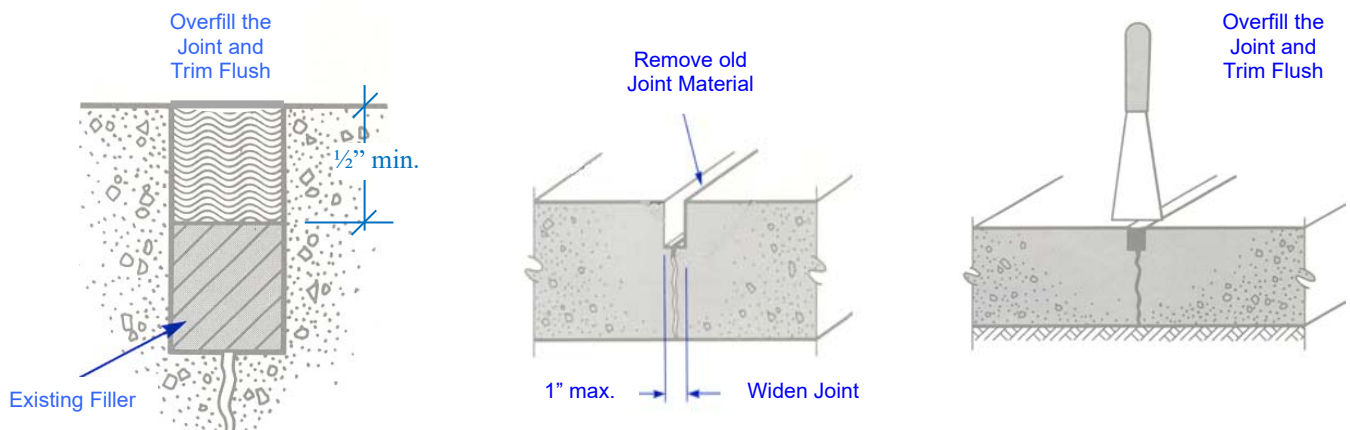
3.01 PRE-SLAB REPAIR INSPECTION

A. The Contractor shall:

1. Conduct a Pre-Repair Inspection meeting at the store with the Store Manager to review the proposed repair procedures and to discuss the required methods and procedures to achieve the required repairs at least 30 days prior to the start of the concrete repair schedule.
2. Require responsible representatives concerned with the repair work to attend the Pre-Repair Inspection meeting, including but not limited to:
 - a. Contractor's Representative: The Contractor's Representative that participates in the Pre-Repair Inspection meeting shall be present during all repairs.
 - b. Material Manufacturer Representative.
 - c. Facility Service Associate (FSA).
 - d. Lowe's Representative: Retail Facility Manager (RFM), Construction Design Manager (CDM)
 - e. Authorized Store Personnel
3. The Contractor to record and distribute typed minutes to all concerned parties, including the Owner's representative and parties representing the Owner, within five days of meeting date.

3.02 JOINT FILLER REPLACEMENT (GENERAL NOTES)

- A. All interior construction and contraction joints for slabs on grade, subjected to vehicular traffic, shall be refilled where needed. Application shall be done in accordance with manufacturer's instructions and shall not exceed 1" width.
- B. During the initial store inspection, the Contractor will determine if the joints to be repaired contain backer-rod or other materials that would inhibit full depth filler installation as part of the repaired joint construction. If it is determined that the Contractor did not remove all backer-rod or other materials, or that the joint was incorrectly repaired, the Contractor will be responsible for all costs associated to replace all joint filler in those areas.
- C. The Contractor will confirm if there is backer-rod, or other materials present that would inhibit full depth (filled to base of original saw cut, or 2" minimum) joint filler installation by pre-drilling through the existing joint filler.
- D. Joint repair work evaluation and completion shall be conducted up to the base of all rack systems, ensuring a clean transition from existing and new joint filler material.



3.03 PARTIAL DEPTH JOINT FILLER REPLACEMENT

- A. Description: Mill and cap any floor joint filler that is stable and cannot be forced downward with strong hand tool pressure, but has:
 - 1. A concaved, recessed, or chattered surface profile and/or is collecting dirt.
 - 2. All cohesive (center) separations greater than 1/32" (credit card width).
 - 3. All adhesive or side wall separations greater than 1/32".
 - 4. No evidence of backer-rod, foreign debris, or voids below filler.
- B. Product:
 - 1. "QWIKjoint UVR" by Euclid Chemical.
- C. Preparation:
 - 1. From finish floor, cut down a minimum 1/2" through the existing joint filler material with a dry-cut, fire-resistant, vacuum-equipped saw, as approved for joint filler removal and preparation, using a slightly oversized blade.
 - 2. Only use a specified vacuum system for cutting and removal.
 - 3. Joint facings must be clean and possess an open surface texture with removal of all oil, dirt, debris, paint, curing compounds, sealers, or any other material that may be a bond breaker.
 - 4. The final preparation step should be the complete vacuum removal of all residues.
- D. Repair:
 - 1. Fill joint or crack full depth of prepared cavity with specified polyurea joint filler.
 - 2. Overfill the joint with filler and shave smooth. Joint filler shall be full depth of joint, and must be flush with adjacent slab edges, with no chattered or concaved profile within the joint.
- E. Appearance:
 - 1. Joint filler installed flush with squared concrete edge and does not exhibit concaved, recessed, or chattered surface profile. Finished joint profile should be smooth and free of any voids.

3.04 FULL DEPTH JOINT FILLER REPLACEMENT

- A. Description: Completely remove any floor joint filler if:
 - 1. Joint filler is loose and can be forced down with firm hand tool pressure.
 - 2. Voids, debris, and/or backer-rod are within 2" below filler.
 - 3. Joint filler is less in depth than the original sawcut.
 - 4. Cohesive (center) separations are greater than 1/32" (credit card thickness).
 - 5. Adhesive or sidewall separations are greater than 1/32".
- B. Product:
 - 1. "QWIKjoint UVR" by Euclid Chemical.
- C. Preparation:
 - 1. Re-saw joint full depth with dry-cut, vacuum-equipped saw, as approved for joint filler removal and preparation, using a slightly oversized blade. The blade width should be sufficient to encapsulate the widest spall along a given contraction joint segment to produce a sharp corner on each side of the joint with a minimum of two passes through the joint.
 - 2. Use specified vacuum system for cutting and removal. Remove all existing joint filler, debris, backer-rod material, and laitance in preparation for refilling.
 - 3. All joint facings must be clean and possess an open surface texture with removal of all oil, dirt, debris, paint, curing compounds, sealers, or any other material that may be a bond breaker.
 - 4. The final preparation step should be the complete vacuum removal of all residues.
- D. Repair:
 - 1. Fill joint or crack full depth with specified polyurea joint filler. This may require more than one pass.
 - 2. Overfill the joint with filler and shave smooth after initial material curing.
 - 3. Joint filler must be flush with adjacent slab edges, with no chattered or concaved profile in the joint.
- E. Appearance:
 - 1. Joint filler installed flush with squared concrete edge and does not exhibit concaved, recessed, or chattered surface profile. Finished joint profile should be smooth and free of any voids.

3.05 JOINT SEALANT INSTALLATION

- A. Description: Joint sealant is severely cracked and/or is missing or out of place.
- B. Product:
 - 1. "Eucolastic 1 NS / SL" by Euclid Chemical
- C. Preparation:
 - 1. Remove foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - 2. Clean, porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealant. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. All surfaces to be sealed shall be clean and dry. All exterior construction and contraction joints for slabs on grade, subjected to vehicular traffic, shall be re-sealed where needed. Application shall be done in accordance with manufacturer instructions.
- D. Repair:
 - 1. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
 - 2. Priming: Prime areas to be sealed as required by manufacturer.
 - 3. Sealant Backings: Install sealant backings to support sealants during application and at position required to produce optimum sealant movement capability. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials. Do not stretch, twist, puncture, tear, or leave gaps between ends of sealant backings. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
 - 4. The width to depth ratio of sealant should be equal for joints that are $\frac{1}{4}$ " to $\frac{1}{2}$ " in width. All deep cracks shall be filled to a maximum depth of $\frac{1}{2}$ " of the surface with an appropriate back-up material and sealed with a caulking gun. Sealant beads shall be smooth and straight.
 - 5. Sealant Installation: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated. Place sealants so they directly contact and fully wet joint substrates.
 - 6. Seal around all door and storefront openings, where noted on the drawings.
 - 7. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint.
 - 8. Remove excess sealants from surfaces adjacent to joint.
- E. Appearance:
 - 1. Joint sealant shall be smooth in texture, shall seal the surface from moisture intrusion, and shall match adjacent concrete color.

3.06 POPOUTS / BOLT REPAIRS

- A. Description:
 - 1. Small popouts at the surface of the concrete sales floor that are from $\frac{1}{2}$ " to 2" in diameter shall be prepared and filled with two-part rigid urethane.
- B. Product:
 - 1. "QWIKstitch" by Euclid Chemical.
 - 2. "Rapid Refloor" by Metzger/McGuire
- C. Preparation:
 - 1. For spall fractured edge less than 30 degrees, vertically square edge to a minimum $\frac{3}{8}$ " depth with either a drill bit or chisel.
 - 2. Clean cavity of all debris and laitance with drill activated brass wire wheel. All oil, debris, paint, and other materials that may be a bond breaker must be removed.
 - 3. Vacuum hole to remove all dirt, debris, and other laitance.
- D. Repair:
 - 1. Fill repair material slightly higher than adjacent surface.
 - 2. Hand grind repair material flush to surface with a grinding stone.

E. Appearance:

1. The repair surface profile shall be smooth, free of voids and blend seamlessly into adjacent surface.

3.07 DELAMINATIONS AND SPALLED CONCRETE FLOOR SURFACES

A. Description:

1. Delaminated and spalled areas of the concrete sales floor.

B. Product:

1. "Euco-Speed" by Euclid Chemical
2. "Armor-Hard Extreme" by Metzger/McGuire

C. Preparation:

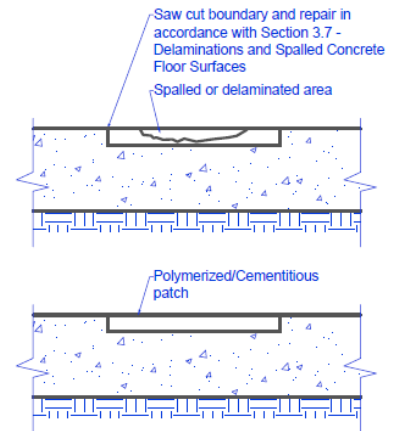
1. Sawcut a minimum of ½" deep, 1" outside the perimeter of repair area with a minimal number of sides and no intersecting over cuts. Sawcuts should be made to create a symmetrical square or rectangular repair area, parallel to the exterior side walls of the building structure.
2. Remove existing concrete as necessary to provide a minimum ½" patch thickness at all locations.
3. All oil, dirt, debris, paint, and other materials that may be a bond breaker must be removed.
4. Clean and apply primer material per manufacturer's recommendation.

D. Repair:

1. Install prepared area with polymerized cementitious patch material. Place patch material flush with the surface of the floor.
2. As the patch material hardens, apply a trowel finish to match adjacent concrete.
3. Re-cut all original floor joints after patch is completed and refill in accordance with Section 3.2 Joint Filler Replacement.
4. Follow manufacturer's recommendations for material curing.

E. Appearance:

1. The repair surface profile shall be smooth, free of voids and blend seamlessly into adjacent surface.



3.08 NARROW RANDOM CRACK REPAIR (1/8" – 1/4")

A. Description:

1. Crack width is 1/8" to ¼". Do not repair cracks less than 1/8".

B. Product:

1. "QWIKstitch" by Euclid Chemical.
2. "Rapid Refloor" by Metzger/McGuire

C. Preparation:

1. Remove loose concrete, dirt, and debris from crack with a wire brush or hand grinder with twisted wire wheel attachment.
2. Remove any loose segments, including islands formed by crack, with sharp tool.
3. Use methods that will not widen existing crack.
4. Repair surfaces must be clean and dry at time two-part rigid urethane is introduced into the crack. Clean crack using specified vacuum.

D. Repair:

1. Dependent upon manufacturer's recommendations, install two-part rigid urethane neat or with manufactured sand as follows:
 - a. Neat installation:
 - a. Install into crack and monitor for seepage. Re-apply wherever material drops into crack cavity below the floor surface. Multiple applications may be required.
 - b. Ensure that the material profile is slightly overfilled and allowed to cure.
 - c. In approximately 30 minutes, remove excess material with hand grinder using a grinding stone.

3. Manufactured sand blend installation:
 - a. Install two-part rigid urethane along a short length of the crack to be repaired.
 - b. Depending on crack width, introduce small amounts of dry 30-70 grit manufactured sand along the length of the crack and filling any voids that might exist as a result of the cleaning procedures. Follow introduction of sand with two-part rigid urethane, saturating the sand.
 - c. A margin trowel or scraper may be used to keep material confined to the vicinity of the crack. Continue introducing sand and two-part rigid urethane along crack until crack is full. Once repair of a section starts, flow of material should not be interrupted for more than one minute at any one time. When two-part rigid urethane cures (turns gray) in about 10 minutes, remove excess material with a sharp scraper or hand grinder using a grinding stone.
 - d. Polish or burnish to match adjacent surface.
 - E. Appearance:
 1. The repair surface profile shall be smooth, free of voids and blend seamlessly into adjacent surface.
- 3.09 TYPICAL RANDOM CRACK REPAIR ($\frac{1}{4}" - \frac{3}{4}"$)
- A. Description:
 1. Crack width is $\frac{1}{4}"$ to $\frac{3}{4}"$.
 - B. Product:
 1. "QWIKstitch" by Euclid Chemical.
 2. "Rapid Refloor" by Metzger/McGuire
 - C. Preparation:
 1. Saw top or edge of crack to provide vertical square edge, minimum $\frac{3}{4}"$ in depth.
 2. Use small hand grinder with maximum 5" diameter blade, minimizing eventual crack width while maintaining uniformity of shape.
 3. Clean crack cavity.
 4. Vacuum crack to remove all dirt, debris, and other laitance.
 5. Remove all visible moisture.
 6. Mask slab surface along crack as necessary to minimize overfill.
 - D. Repair:
 1. For cracks up to $\frac{3}{4}"$ in width, install with manufactured sand as follows:
 2. Install two-part rigid urethane along a short length of the crack to be repaired.
 3. Depending on crack width, introduce small amounts of dry 30-70 grit manufactured sand along the length of the crack and filling any voids that might exist as a result of the cleaning procedures. The top of the sand fill should be a minimum of $\frac{3}{4}"$ below the top of the slab surface. Follow introduction of sand with two-part rigid urethane, saturating the sand.
 4. A margin trowel or scraper may be used to keep material confined to the vicinity of the crack. Continue introducing sand and two-part rigid urethane along crack until crack is full. Once repair of a section starts, flow of material should not be interrupted for more than one minute at any one time. When two-part rigid urethane cures (turns gray) in about 10 minutes, remove excess material with a sharp scraper or hand grinder using a grinding stone.
 5. Polish or burnish to match the adjacent surface.
 - E. Appearance:
 1. The repair surface profile shall be smooth, free of voids and blend seamlessly into adjacent surface.
- 3.10 WIDE RANDOM CRACK REPAIR ($\frac{3}{4}" - 1"$)
- A. Description: Wide random cracks from $\frac{3}{4}"$ to 1".
 - B. Product:
 1. "QWIKjoint UVR" by Euclid Chemical.
 - C. Preparation:
 1. All crack facings must be clean and possess an open surface texture with removal of all oil, dirt, debris, paint, curing compounds, sealers, or any other material that may be a bond breaker.
 2. The final preparation step should be the complete vacuum removal of all residues.

- D. Repair:
1. Install polyurea joint fill material for cracks from over ¾", not exceeding 1" in width.
 2. Dispense sample into small bucket to test blending of material.
 3. Prime crack with repair material.
 4. Dispense material, dragging dispenser tip along crack, until it flows over the slab.
 5. Wait approximately 10 minutes, periodically checking for material cure.
 6. Check condition of material by shaving with razor scraper.
 7. When cured, shave material flush to slab surface per manufacturer's instructions.
- E. Appearance: The repair surface profile shall be smooth, free of voids and blend seamlessly into adjacent surface. Finished surface profile should be smooth and free of any voids.
- 3.11 UNEVEN FLOOR JOINTS OR CRACKS
- A. Description: Slab on one side raised above other side more than 1/8". Crack width, greater than 1/16" but less than 3/4". Joint width less than 1".
- B. Product:
1. "QWIKjoint UVR" by Euclid Chemical.
- C. Preparation:
1. Hand grind raised concrete surface flush to adjacent edge, minimizing the width of hand ground surface to that necessary to install repair material without leaving feathered overfill material at the slab surface.
- D. Repair:
1. Repair floor joint as specified herein under "3.02 Joint Filler Replacement".
 2. Repair crack as specified herein under "3.08 Narrow Random Crack Repair (1/8" – 1/4") for cracks not to exceed 1/4" in width, and "3.10 Wide Random Crack Repair (3/4" - 1")" for cracks up to 1" in width.
 3. For Exterior, re-seal joint as specified in herein under "3.05 Joint Sealant Installation."
- E. Appearance: The repair surface profile shall be smooth, free of voids and blend seamlessly into adjacent surface.
- 3.12 VESTIBULE REPAIR FOR SEVERELY WORN, PITTED AND / OR SPALLED CONCRETE
- A. Description: Existing vestibule is severely worn and/or pitted and spalled from traffic and/or de-icing salt exposure
- B. Products:
1. Moisture Mitigation: "Dural Aquatight 100 Plus" by Euclid Chemical.
 2. Low Modulus Epoxy: "Flexolith" (Clear) by Euclid Chemical.
 3. Aggregate "Granusil 2095" by Covia Products, Chardon, OH – 800-243-9004, or aggregate of similar size, gradation, and color to the following:

ASTM	MICRONS	2095 (% RETAINED)
6	3.35MM	-
8	2.36MM	-
10	2.20MM	3.5
12	1.7MM	14.3
16	1.18MM	45.1
20	850	28
30	600	5.9
35	500	-
40	425	1.4
50	300	1.0
60	300	-
70	212	-
100	150	0.8
140	106	-
200	75	-
270	53	-
PAN	PAN	-

4. Body Coat Epoxy Coating: "Duraltex Fast" (Clear) by Euclid Chemical.
 5. Water-Based Polyurethane: "Tammoshield" ("Matte" finish) by Euclid Chemical.
- C. Preparation:
1. Environmental Limitations: Apply this system within the range of ambient and substrate temperatures recommended in writing by manufacturer. Store Flexolith indoors, protected from moisture, at temperatures between 40°F and 90°F (4°C and 32°C). Surface and ambient temperature during coating applications should be between 40°F and 90°F (4°C and 32°C). Material temperatures should be at least 40°F (4°C) and rising. Do not apply this system to wet substrates.
 2. Production Limitations: Repair Contractor shall schedule adequate time for the successful installation of the specified system. Based on the square footage of the vestibule and number of entrances/exits from the building, careful coordination with the Store Manager is required, including, but not limited to, staging and/or dividing the vestibule into multiple work areas.
 3. Surface Preparation: The surface must be structurally sound, clean, and free of grease, oil, curing compounds, soil, dust and other contaminants that may interfere with bond. New concrete must be at least 28 days old. Surface laitance must be removed. Concrete surfaces must be roughened and made absorptive by shotblasting, and then thoroughly cleaned of all dust and debris. The Concrete Surface Profile (CSP) should be equal to CSP 4-6 in accordance with Guideline 310.2R-2013, published by the International Concrete Repair Institute (ICRI). Allow substrate to dry before coating application. Following surface preparation, the strength of the surface can be tested if quantitative results are required by project specifications. An elcometer or similar tensile pull tester may be used in accordance with ASTM C1583, and the tensile pull-off strength should be at least 250 psi (1.7 MPa).
 4. Vestibules without Thermostatic Control: All slab on ground control joints shall be honored in vestibules that are not thermostatically controlled for hot and cold ambient temperatures. Joints shall be cut over existing joints in the base slab and shall be filled full depth with semi-rigid polyurea joint filler as specified in Section 3.04, "Full Depth Joint Filler Replacement." Joint filler shall be tinted to match the vestibule repair as specified herein.
- D. Repair:
1. Moisture Mitigation System:
 - a. Surface Preparation: The concrete substrate must be cured a minimum of 7 days and have a surface tensile strength of greater than 200 psi (1.4 MPa) and have a compressive strength greater than 3,500 psi (24.3 MPa) before coating. The surface must be structurally sound, clean, and free of dirt, grease, oil, curing compounds, soil, dust, densifiers, water soluble unreacted sodium/potassium silicates, oil or wax-based sweeping compounds and other contaminants. The concrete slab must not be in an active state of ASR or NSAR or be exposed to hydrostatic pressure. Surface laitance must be removed. All substrates must be properly prepared with shot blasting ONLY (unless another method is approved by Euclid Chemical) to achieve a minimum CSP 3-4 surface profile in accordance with Guideline 310.2R-2013, published by the International Concrete Repair Institute (ICRI) and then thoroughly cleaned of all dust and debris. For concrete slabs that have an existing, or previously installed floor covering or coating system, laboratory examination of core samples is required. Consult with Euclid Chemical for recommendations before proceeding with surface preparation. The prepared surface of the concrete must be porous. Test the prepared surface in accordance with ASTM F3191. The prepared surface must be able to completely absorb a single drop of water in 60 seconds. Conduct one test per each 100 square feet. Areas that fail this test must be further prepared until a passing test is achieved.
 - b. Non-Moving Cracks: Cracks less than 1/8" wide can be filled with Dural Aquatight 100 plus. cracks larger than 1/8" wide can be filled with a mortar consisting of properly mixed Dural Aquatight 100 Plus, and sand. once the non-moving cracks have been filled, and while it is still wet, broadcast sand to refusal. Allow to cure thoroughly and then remove all excess sand prior to proceeding with the application.

- c. Moving Cracks, Saw Cut Joints: All moving joints and cracks must be honored up through the moisture mitigation system any underlayment and floor covering material. Saw Cut Joint sidewalls and the bottom of the joint should be coated with Dural Aquatight 100 Plus then allowed to cure for 12 to 24 hours. Then the Saw Cut Joint should be filled with a joint filler recommended by Euclid Chemical.
 - d. Expansion Joints: The Expansion Joint sidewalls and bottom of the joint shall be coated with Dural Aquatight 100 Plus and allowed to cure 12 to 24 hours. Then a suitable backer rod should be placed in the joint and the cavity filled with a joint filler recommended by Euclid Chemical.
 - e. Mixing: Part A and Part B are contained in a 5-gallon plastic pail. Mix parts A & B (resin & hardener) separately using a drill and mixing prop. Then, pour the Part B into the Part A container. Mix for at least 3 minutes, scraping the bottom and sides of the container, to ensure proper chemical reaction. To keep aeration to a minimum, the recommended mixing paddles are #P1 or #P2 as found in ICRI Guideline 320.5R-2014.
 - f. Application: Quickly spread the properly mixed Dural Aquatight 100 Plus using a flat or notched squeegee ensuring that proper coverage rates are achieved and that there is a minimum 12 mil coverage over all high spots on the properly prepared concrete. Backroll the spread material using a 3/8" shot nap roller that is suitable for epoxy resins to ensure even coverage. Resinous Coatings: Can be applied directly over the Dural Aquatight 100 Plus upon cure. Resinous coatings should be applied within 72 hours. Perform a test patch to confirm adhesion and compatibility.
2. Low Modulus Epoxy:
- a. Mixing: Mix Flexolith (Clear) using a low-speed drill and a mixing paddle. Pre-mix Part A and Part B separately for approximately 1 minute each. Combine Part A and Part B in a 1 to 1 ratio by volume, then mix thoroughly for 3 minutes. A low-speed drill and a mixing paddle may be used for small quantities, and a horizontal shaft mortar mixer may be used for large quantities. Scrape the bottom and sides of the containers at least once during mixing. Do not scrape bottom or sides of the container once mixing operations have ceased; doing so may result in unmixed resin or hardener being applied to the substrate. Unmixed resin or hardener will not cure properly. Do not aerate the material during mixing. To keep aeration to a minimum, the recommended mixing paddles are #P1 or #P2 as found in ICRI Guideline 320.5R-2014.
 - b. Application: Properly mixed "neat" Flexolith (Clear) shall be applied at a rate of 45 ft² per mixed gallon to the prepared surface using a magic trowel, notched squeegee, short nap roller, or a combination of the above.
3. Aggregate:
- a. Application: While the Flexolith is still wet, broadcast clean, dry Granusil 2095 aggregate, or equal, at a rate of 1.25 lbs. per square foot into the resin to "refusal" (until the aggregate is no longer being saturated by the coating). If any area of aggregate looks "wet" during the broadcast, immediately broadcast additional aggregate over those areas. Allow the coating to cure, and then sweep and/or vacuum up the excess aggregate.
4. Body Coat Application:
- a. Properly mixed "neat" Duraltex Fast (Clear) shall be applied at a rate of 18 ft² per mixed gallon to the prepared surface using a magic trowel, notched squeegee, short nap roller, or a combination of the above. Allow this application of Duraltex Fast to dry. A second application of Duraltex Fast may be necessary to achieve the proper skid resistance. This application is typically at 60 ft² per mixed gallon.

5. Water Based Polyurethane:
 - a. Apply a final seal coat of Euco Tammoshield (Matte Finish) at a rate of 400 ft² per gallon over the Duraltex Fast coated aggregate broadcast.
 - E. Appearance:
 1. Vestibule repair shall exhibit a non-slip surface with a "matte" or "sheen" appearance.
- 3.13 SLIGHTLY WORN SLAB REQUIRING POLISHABLE, SELF-LEVELING OVERLAYMENT
- A. Description: Sales floor area, including light foot traffic aisles that exhibit slight to moderate wear, some significant spalling, and/or aggregate exposure.
 - B. Products:
 1. "Level Top" by Euclid Chemical
 2. "Rapid Set TRU PC" by CTS Cement
 3. "Rapid Set TXP Fast" by CTS Cement
 - C. Preparation:
 1. The concrete surface must be free of unbound cementitious by-products, loose dirt, oil, grease, or other contamination. Interior surfaces should be prepared by mechanical means (shot-blast, sandblast or by rotary sander). Before installing overlay product, all concrete subfloors must be primed per manufacturer's recommendations. Overlay product should only be installed when ambient and substrate surface temperatures are between 50° F and 90° F, or per manufacturer's recommendation. Optimum temperature installation is approximately 70° F.
 - D. Repair:
 1. Material to be mixed per manufacturer's recommendations. Mix in a clean damp paddle mixer (mortar mixer). A drill and paddle mixer may also be used. When using integral colorants, add colorant to water prior to the addition of powder.
 2. Recommended Thickness. Thickness to be per manufacturer's recommendation, minimum, 1/8" to 1". For placements greater than 1" use with extended aggregates.
 - E. Staining / Sealing / Polishing: After placement and minimum curing of overlay product stains or dyes may be applied. Consult manufacturer's representative for additional polishing/densifier requirements.
 - F. Appearance:
 1. Polishable, self-leveling overlayment shall exhibit a durable polished surface that matches the color of the surrounding concrete.
- 3.14 SEVERELY WORN SLAB REQUIRING AN ABRASION RESISTANT WEAR TOPPING
- A. Description: Sales floor area, including "Shipping and Receiving" and main traffic aisles that are unsuitable for customers, including extremely worn, significant spalling and/or aggregate exposure.
 - B. Products:
 1. "EucoFloor 202" by Euclid Chemical
 - C. Preparation:
 1. Surface Preparation: Concrete surfaces must be structurally sound, free of loose or deteriorated concrete, and free of dust, dirt, paint, efflorescence, oil and all other contaminants. Mechanically abrade the surface to achieve a surface profile equal to CSP 5-7 in accordance with ICRI Guideline 310.2. Properly clean profiled area.
 2. Perimeter Keyway: Feather edging the material to meet the surrounding concrete is not acceptable. Secure the material along the exposed edges by saw cutting and keying the material into the base slab. The keyway must be a minimum of 1" deep beneath the surface of the surrounding concrete. This will allow the topping to have an adequate thickness at the termination point where the topping meets the adjacent slab.
 3. Priming: Apply mixed EucoFloor Epoxy Primer (see product data sheet for mixing instructions) to the properly prepared substrate at a rate of 75 to 100 ft²/gal. Squeegee the epoxy into place; scrub it into the substrate, then backroll to ensure a uniform application. While the epoxy is still wet, broadcast washed & dried 16/30 mesh silica sand onto the surface until it is completely saturated with sand and appears dry. Application rate for the silica sand is approximately 1 lb./ft. After the sand is applied, the surface should have a uniform appearance with no damp or wet areas visible. If so, apply more sand to those areas until they appear dry. Allow the epoxy to cure, preferably

overnight. After the epoxy has cured, remove all loose, unbonded sand by sweeping and/or vacuuming it off prior to topping application.

D. Repair:

1. Mixing: For best results, all materials should be conditioned to the proper temperature range of 55-85° F. The mixing water range for EucoFloor 202 is from 7.5% - 8.5% by weight. For 50 lb. bags, use 0.45 to 0.51 gallon of potable water. Mix small bags with the appropriate amount of

water for 3 minutes. When using 3,000 lb. super sacks, mix in a clean ready-mix truck with 27.0 to 30.0 gallon per super sack. Mix in the truck for 7 to 10 minutes after the final addition of the material and water. EucoFloor 202 will have a 7" to 8" slump. If the placement depth of EucoFloor 202 is thicker than 2 inches, extend the product with washed and dried 3/8" pea gravel. The extension rate will be 15% by weight of powdered material.

2. Placement: Minimum thickness for EucoFloor 202 is 5/8". Place the material on the prepared substrate and move into place with shovels and concrete rakes. The use of a light duty vibratory or roller screed for large placements is necessary. Immediately after screeding, apply a coat of diluted Eucobar (see technical data sheet for mixing instructions). This will reduce evaporation and aid in floating. After the material is in place, float the surface to a smooth and flatten it out. Once the product has set sufficiently, the topping will accept a trowel machine and can be finished similar to concrete. EucoFloor 202 is more susceptible to blistering while power troweling. Do not use water when troweling. If additional lubrication is needed, use Eucobar Evaporation Retardant. NOTE: Always re-establish the joints from the base concrete up through the topping.
3. Curing: EucoFloor 202 must be cured with a high solid curing compound immediately after troweling. Use Super Diamond Clear VOX at a rate of 250 to 300 ft²/gal. If conditions are unusually dry, water cure after placement of the curing compound and cover with plastic film or blankets.

E. Appearance:

1. Abrasion resistant wear topping shall exhibit a durable polished surface that matches the color of the surrounding concrete.

3.15 FULL DEPTH SLAB REPLACEMENT (NOT TO INCLUDE SHAKE HARDENER SLABS)

- A. Description: Slab defect that exhibits severe pitting or spalling, which exceeds a third of the slab panel area or 3/4" in depth or as recommended by the Lowe's Representative.

1. Avoid traffic on newly placed concrete for a minimum of 7 days. If traffic must be on the slab prior to this time, an alternate "High Strength-Early Set" mix design may be used upon approval of the Lowe's Representative.
2. Provide submittals, use products, and execute in accordance with Lowe's Concrete Specifications, Section 03300 Cast-in-Place Concrete.

B. Preparation:

1. Submit all procedures and products to the Lowe's Representative for review and approval prior to starting work. If necessary, the Lowe's Representative will contact a floor repair consultant for further review of the submittal package.
2. The intent of the slab replacement is that the repair area shall be encompassed by existing slab joints on at least 3 adjacent sides. Verify exact repair area size and location with the Lowe's Representative before commencing work.
3. Saw cut at outer edges of pitted or spalled areas. The cuts should be symmetrical in nature and made perpendicular and parallel to the slab joints creating a rectangular repair area. The Repair Contractor should avoid any over-cutting at saw cut intersections.

C. Repair:

1. Concrete shall be designed to meet 4000 psi compressive strength within 28 days.
2. Alternate "High Strength-Early Set" mix design shall meet 4000 psi compressive strength within 24 hours. Refer to mix design below:

Materials	Prototype Concrete Mix
Cement	728-800 lbs.
Fly Ash/Slag	Prohibited
Coarse Aggregate	11 Cubic Feet +/- .50
Fine Aggregate	7 Cubic Feet +/- (Adjust as Necessary)
Water Content	291 – 320 lbs.
Air Content (Entrapped Air – Interior Only)	3.0% (Max.)
Air Content (Entrained Air - Exterior Only)	5.0% +/- 1.0% (Max.)
Mid-Range Water Reducing Admixture (Type A/F)	3oz - 10oz/100wt +/-
High-Range Water Reducing Admixture (Type F/G)	3oz - 6oz/100wt +/- (Polycarboxylate)
Non-Chloride Accelerating Admixture	28oz - 40oz/100wt +/- (add at jobsite)
Shrinkage Reducing Admixture	As Required
W/cm	0.40 (Max)
Initial Slump (Water)	2"
Final Slump	5.5" (Max)
Shrinkage	≤ 0.04% @ 28 days

3. Construction joints in slab on grade shall be butt joints with smooth, round, or square plate dowels. All dowels shall be installed per manufacturer's instructions.
4. Mix design shall comply with ACI 301 requirements and Lowe's Section 03300 or 03310.
5. Re-compact existing subgrade, if required.
6. Replace vapor retarder, if required.
7. Install concrete flush with the surface of the floor. Apply a trowel finish to match adjacent concrete.
8. Re-cut original joint through repair. Repair material shall not permanently bridge joints. Either maintain original joint during repair with and insert or cut as soon as repair material will not ravel or dislodge from sawing.
9. Re-fill joint as specified herein, "3.04 Full Depth Joint Filler Replacement" (Interior).
10. Re-seal joint as specified herein, "3.05 Joint Sealant Installation". (Exterior).
11. Appearance: Abrasion resistant wear topping shall exhibit a durable polished surface that matches the color of the surrounding concrete.

3.16 FULL DEPTH SLAB REPLACEMENT (SHAKE HARDENER SLABS)

- A. Description: Slab defect that exhibits severe pitting or spalling, which exceeds a third of the slab panel area or ¾" in depth or as recommended by the Lowe's Representative.
 1. Avoid traffic on newly placed concrete for a minimum of 7 days. If traffic must be on the slab prior to this time, an alternate "High Strength-Early Set" mix design may be used upon approval of the Lowe's Representative.
 2. References:
 3. Provide submittals, use products, and execute in accordance with Lowe's Concrete Specifications, Section 03310 - Cast-in-Place Concrete – Shake Hardener.

3.17 VERTICAL AND OVERHEAD REPAIR

- A. Description: Interior or exterior vertical and overhead areas requiring cosmetic cementitious repairs.
- B. Product: "EucoRepair V-100" by Euclid Chemical
- C. Preparation:
 - 1. Concrete surfaces must be structurally sound, free of loose or deteriorated concrete, and free of dust, dirt, paint, efflorescence, oil and all other contaminants. Mechanically abrade the surface to achieve a surface profile equal to CSP 5 - 7 in accordance with ICRI Guideline 310.2. Properly clean profiled area.
 - 2. Priming: Clean and prime exposed steel with Duralprep AC. Concrete should be primed with a spray or brush coat of Duralprep AC. The primer coat of Duralprep AC must be allowed to thoroughly dry prior to the application of EucoRepair V100. Alternately, a Saturated Surface Dry (SSD) concrete surface can be primed with a scrub coat of EucoRepair V100. The repair must be made before the scrub coat dries out.
- D. Repair:
 - 1. Mixing: Single bags may be mixed with a drill and "jiffy" type mixer. Use a paddle type mortar mixer for large jobs. All materials should be in the proper temperature range of 60°F to 90°F. Add the appropriate amount of water, 0.9 to 1 gal/bag into a clean mixing vessel, and then add the dry product. Mix for 3 to 5 minutes. Do not mix more material than can be placed within 15 minutes.
 - 2. Placement: Place in 1/8" to 4" lifts for vertical surfaces and 1/8" to 2" lifts for overhead applications. Trowel into place and allow final set before the next lift. If additional lifts are required, score the surface of the placed mortar before it reaches final set.
 - 3. Finishing: Finish the repair material to the desired texture. Do not add additional water to the surface during the finishing operation. Use Eucobar Evaporation Retarder.
 - 4. Curing and Sealing: Curing is required. Cure with a Euclid Chemical high solids, water-based curing compound. (Note: a solvent based curing compound should not be used on this product). Under hot, windy, or direct sunlight situations, apply a second coat of curing compound after the first has dried. If a curing compound is not desired, wet cure for a minimum of three days.
- E. Appearance:
 - 1. Vertical and Overhead Repair shall exhibit a durable surface that matches the surrounding concrete.

3.18 SEVERLY WORN, PITTED AND / OR SPALLED EXTERIOR CONCRETE

- A. Description: Existing exterior concrete is severely worn and/or pitted and spalled from traffic and/or de-icing salt exposure
- B. Product:
 - 1. "Euco Re-Cover" by Euclid Chemical
- C. Preparation:
 - 1. Surface preparation: concrete surfaces must be structurally sound, free of loose or deteriorated concrete and be free of curing and sealing compounds, dust, dirt, paint, efflorescence, oil, and all other contaminants. Typically, pressure washing the surface with a commercial pressure washer (3000 psi, 4 gpm) and allowing to fully dry will be sufficient for preparation. In areas of heavy contamination, preparing the concrete through mechanical means is recommended. Abrade the surface to a profile of at least CSP 2, in accordance with ICRI guideline 310.2.
 - 2. Priming: apply Euco Re-Cover to dry surfaces. Although a primer is typically not needed, if pinholes form in the Euco Re-Cover due to application on porous surfaces, Tammsweld bonding adhesive should be used. Refer to the Tammsweld technical data sheet for further instructions.
- D. Repair:
 - 1. Mixing: all materials should be conditioned to the appropriate temperature range of 50°F - 90°F. Prior to mixing and placement. Euco re-cover mixes with 4.5 quarts of clean, potable water for standard overlay applications. Up to an additional pint can be added when the temperature exceeds 80°F. For repairing deeper spalls prior to overlaying, Euco Re-Cover can be mixed with 3.5 to 4 quarts of water to make a stiff paste suitable for spall repairs. Place 80% of the mixing water into a clean pail. Slowly add the dry Euco Re-Cover powder into the mixing pail. During this time, the material should be mixed with a drill and "jiffy" type mixing paddle. Slowly add the remaining 20% of the mixing water to the pail and mix for 3 minutes to achieve the desired consistency. Place immediately.

2. Coloring: Euco Re-Cover shall be integrally colored to match the surrounding concrete slab color. Add the desired liquid or dry colorant to the mixing water and stir until colorant evenly disperses throughout the water. Continue mixing in the Euco Re-Cover as Directed. For even results, it is a best practice to "box" all mixing water that has been colored prior to mixing individual bags of Euco Re-Cover.
 3. Placement: Place the mixed Euco Re-Cover onto the concrete in the desired area. For best adhesion to concrete, use a scrub brush or stiff street broom to scrub the material onto the prepared substrate. Following the initial placement of the material to the concrete, finish as desired, using either a trowel or a broom. The maximum placement depth of Euco Re-Cover is 3/8". Since Euco Re-cover is a thin applied material, surface and air temperatures greatly affect the working time of the material. On hotter days (temperature 80 degrees and above), it is best practice to work in small, controlled areas to avoid cold joints. Use Euclid Chemical's Eucobar Evaporation Retardant to retain moisture in the material and to provide longer finishing time. Working from joint to joint in the base concrete is a good practice. All saw cuts and joints in the base concrete will have to be honored through the Euco Re-Cover material.
 4. Curing and sealing: Proper curing procedures are important to ensure the durability and quality of the repair. As soon as the material can be walked on without harming the finish, apply a water-based curing and sealing Compound to the Euco Re-Cover. If you can apply a cure and seal sooner from the sides of the project, then do so. The use of Euclid Chemical's EverClear VOX is highly recommended for use on this product.
- E. Appearance:
1. Light broom finish. Color to match surrounding concrete slab.

PART FOUR - CLOSEOUT (AT COMPLETION OF PROJECT)

- 4.01 The Contractor is to furnish the following to the Lowe's Representative:
- A. Prior to leaving the project, the Contractor shall walk the floor and view all floor repairs performed with the Authorized Store Personnel to address any punch list and/or closeout items.
 - B. Lowe's Floor Repair Log shall state that all items have been completed. Log must be initialed on each page by the Authorized Store Personnel. The last page must have the printed name of the Authorized Store Personnel along with his or her signature and the date of acceptance.
 - C. List of all Contractors employed to work showing names, addresses, telephone numbers, and respective trade.
 - D. Notarized copy with raised stamp of "Contractors Affidavit of Release of Liens" (AIA, G706A) from Contractor or approved Subcontractor.
 - E. Copy of 1-year labor and workmanship warranty.
 - F. Copy of manufacturer's standard warranty.
 - G. Repair Material Invoices (Send copies to the Lowe's Representative and product manufacturers).
 - H. Digital photos of the before and after floor repairs. Pictures must be representative of each type repair performed. Upload the final invoice to SAM or Site Folio based on the direction of the Lowe's Representative.

END OF SECTION 03130

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SECTION 03351 - CONCRETE DENSIFIER/SEALER

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. Section 03300 – Concrete Work.

1.2 DESCRIPTION OF WORK:

- A. Extent of surfaces to receive densifier/sealer shall be all interior concrete slabs that are not scheduled to receive a final finish material as indicated on the drawings.

1.3 QUALITY ASSURANCE:

- A. Trained Applicator Qualification: All General Contractors bidding or negotiating a Lowe's project shall contact Euclid Chemical to obtain a list of Trained Applicators located within the geographic region of the project. General Contractors shall solicit and accept pricing only from Trained Applicators as included in the Manufacturer's list. The Trained Applicator selected for joint filling and initial application of liquid densifier/sealer shall be the same as for the polishing process and additional application of liquid densifier/sealer specified herein.
 - 1. All General Contractors bidding or negotiating a Lowe's project shall contact the Euclid Chemical Company to obtain a list of Approved Applicators and Acceptable Distributors located within the geographic region of the project. General Contractors shall solicit and accept pricing only from those Applicators and Distributors as included in the Manufacturer's list. The approved applicator selected for the initial application of liquid densifier/sealer shall be the same as for the polishing process and additional application of liquid densifier/sealer.
- B. Project Mock-Up: Apply densifier/sealer to mock-up, in full coverage as directed, before proceeding with installation. Comply with installation requirements of this section.
- C. Environmental Standards: Comply with provisions of the following:
 - 1. Environmental Protection Agency (EPA) requirements for less than 350 grams per liter of Volatile Organic Compounds (VOC).
- D. Pre-Installation Conference: Prior to installation of densifier/sealer materials and associated work, meet at project site, with Applicator, Manufacturer, Architect and Contractor. Record (Contractor) discussions of conference, together with decisions and agreements (or disagreements) reached. Furnish copy of record to each party attending. Review methods and procedures related to work; including but not necessarily limited to the following:
 - 1. Tour job site areas to receive densifier/sealer. Inspect and discuss conditions of substrate and other preparatory work performed by other trades.
 - 2. Review requirements (drawings, specifications and other contract documents).
 - 3. Review required submittals, both complete and yet to be completed.
 - 4. Review and finalize construction schedule related to work and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.

5. Review compatibility of products with indicated substrates. Provide only products which are recommended by manufacturer to be fully compatible.
 6. Review the specified process, including the required methods and procedures to achieve the required floor finish.
- E. Manufacturers Observation: Two Weeks prior to application of liquid densifier/sealer, the General Contractor shall notify the Euclid Chemical Company for jobsite service. Representative of manufacturer shall periodically make field observations to verify that product and/or material is being installed according to project and manufacturer's specifications.
1. Report: Submit copies of field observation report to Architect and Contractor, stating observations and any directives given to installer.
 2. Form: Format like AIA Document G711 Architect's Field Report.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications, installation instructions, and general recommendations for densifier/sealer. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.
- B. Floor polishing equipment information, including unit's head down pressure and diamond tooling.

1.5 JOB CONDITIONS:

- A. Weather and Substrate Conditions: Do not proceed with application of densifier/sealer (except with written recommendation of manufacturer), when ambient temperature is less than 50°F (10°C), or when substrate surfaces have cured for less than a period of 28 days, or when rain or temperatures below 40°F (4°C), are predicted for a period of 24 hours, or earlier than 3 days after surfaces became wet from rainfall or other moisture sources, or when substrate is frozen, or at surface temperature of less than 40°F (4°C). Floor area substrate to be treated with densifier/sealer shall be clean and free of any materials that could prevent penetration of Euco Diamond Hard, such as curing compounds, or cure & seals, paints, coatings, dirt/oil, waxes, laitance, salts, etc.
- B. Polishing Process Timing: The polishing process and application of liquid densifier/sealer shall take place a minimum of 7 days after the final cast of the interior floor slab and after the concrete compressive strength has reached 75% of design strength, or later in the project sequence, but prior to construction completion/final punch list by Lowe's.

1.6 WARRANTY:

- A. All approved applicators applying the liquid densifier/sealer and polishing process shall have completed official training and will be required to provide a five (5) year labor warranty. This labor warranty is in addition to a twenty (20) year product warranty provided by the manufacturer of the liquid densifier/sealer. All invoices for liquid densifier/sealer indicating the purchase and delivery of liquid densifier/sealer to the project site shall be submitted to the liquid densifier/sealer manufacturer for warranty purposes. Furnish the Owner a written warranty signed by an officer of the liquid densifier/sealer manufacturer and written warranty from approved applicator of the liquid densifier/sealer. All warranties shall start at "construction completion" date.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Concrete densifier/sealer: High performance, deeply penetrating concrete densifier; odorless, colorless, VOC - compliant, non-yellowing siliconate based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces. The compound must contain a minimum solids content of 20% of which 50% is siliconate.

1. Product:

- a. "Euco Diamond Hard" by The Euclid Chemical Company, 19215 Redwood Road, Cleveland, OH 44110. Philip Brandt, Vice President of National Business Development (877) 438- 3826, or (704) 756-0090; e-mail: pbrandt@euclidchemical.com.

- i. All materials shall be dispensed from factory verified numbered and sealed drums for warranty purposes.

2. Equipment:

- a. Auto Scrubber: Auto Scrubber shall be specifically designed to scrub concrete floors with exact control for all heads to ensure equal adjustable down pressure, adjustable rpm and exact forward and reverse speed control independent of the foot control lever.
- b. Grinding/Polishing Equipment: Grinding/Polishing equipment shall be specifically designed to grind, and polish concrete floors with exact control for all heads to ensure equal adjustable down pressure, and adjustable rpm.
- c. Diamond Tooling: Diamond tooling for polishing shall be high quality resin or metal bonded diamonds (matched sets only) that provides a high level of polish to the interior floor surface.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Test Application/Mock-Up: Prior to application of densifier/sealer, prepare a small application in an unobtrusive location and in a manner acceptable to Lowe's, for purpose of demonstrating final visual and physical/chemical of planned installations (both single application and two application with polishing process) using the same equipment, tools and methods as will be used to polish the interior floor slab. Proceed with work only after Lowe's acceptance of test application, or as otherwise directed.
- B. Coordination with Joint Filler/Sealants: Where feasible, delay application of densifier/ sealer until installation of joint filler/sealants has been completed in joints adjoining surfaces to be treated with densifier/sealer.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of densifier/sealer. Cover adjoining and nearby surfaces where there is possibility of densifier/sealer being deposited on surfaces. Clean densifier/sealer from adjoining surfaces immediately after spillage. Comply with manufacturer's recommendations for cleaning.

- D. Immediately following curing process and prior to application of densifier/sealer, inspect and thoroughly clean slab with auto scrubber to ensure that it is clean and free of salts, laitance, dust, grease, oils or other contaminants that might inhibit the proper application and penetration of the liquid densifier/sealer.
- E. Immediately following cleaning process, allow floor slab to dry for twelve (12) hours, prior to applying the first application of liquid densifier/sealer.

3.2 INSTALLATION – FIRST APPLICATION (ALL AREAS):

- A. Immediately following air-drying, apply the first application of liquid densifier/sealer to all interior slabs. Maximum coverage rate shall be 225 sq. ft./gallon. This step shall constitute as the first application of the liquid densifier/sealer.
- B. Before using near asphalt paving, wet paving with water, as any contact with the liquid densifier/sealer on dry asphalt will result in white discoloration.
- C. Care shall be taken when flushing slab with water. Contractor shall be responsible for disposing of excess water by means of trenching, pumping and/or other means, as required to maintain the integrity of adjacent stone base.
- D. Disposal of used and/or diluted liquid densifier/sealer via Storm Sewer, sanitary sewer, surface drainage or surface waters is strictly PROHIBITED. Unauthorized discharge of this material is a violation of the Clean Water Act and will result in the revocation of the GC superintendent's storm water contractor qualified inspector certification and potential fines. All disposals shall be operated through a licensed waste facility. Any questions regarding the proper disposal of the liquid densifier/sealer shall be directed to: Brian Massengill: (336) 480-5627, e-mail: brian.s.massengill@lowes.com. General contractor shall acquire and provide paperwork regarding proposed disposal PRIOR to installation of material for approval.

3.3 CLEANING PRIOR TO POLISHING PROCESS (OFFICE AREAS ONLY):

- A. General: Scrape the floor using a long handle razor scraper as required to remove remaining saw cut residue, form glue, texture overspray, paint drippings, and other built-up material on the surface. If necessary, use a soft damp cloth and non-acidic cleaner. Non-acidic cleaner shall be compatible with the liquid densifier/sealer.
- B. Power-sweep entire floor area with a dust free walk-behind or ride-on sweeper with at least one side broom to get into all corners and around columns.
- C. Treat all oil spots with oil emulsifier and oil absorber materials to remove oils from below the surface. Detail scrub oil spot areas and remove liquids with vacuum or automatic scrubber.
- D. Scrub the entire floor with an automatic scrubber capable of a minimum of 50-120 pounds head pressure, each head to be equipped with cleaning combo or light grit brushes and a neutral pH cleaning detergent that is compatible with the liquid densifier/sealer. Remove liquid as the floor is scrubbed. Scrub the floor a second and final time with clean water only and remove the liquid as the floor is scrubbed. Allow slab to dry for twelve (12) hours.

3.4 POLISHING PROCESS AND ADDITIONAL APPLICATION OF LIQUID DENSIFIER /SEALER (OFFICE AREAS ONLY):

- A. Furnish a square foot cost for additional polishing of the interior slab and applying an additional application of liquid densifier/sealer to the floor surface as required. Include all labor, materials, equipment and services necessary for the wet resin polishing of concrete floors.
- B. This polishing process involves four-steps. Interior slab shall be a minimum of 28 days old prior to commencing with polishing process.
- C. Execution
 - 1. Polishing Process Procedures: The following procedures are provided as a guide. Many factors, including but not limited to interior floor slab finish, hardness and flatness will determine the initial diamond tooling and/or additional polishing operations required to meet the requirements specified herein. The tooling and operations approved during the "Floor Test Slab" application shall be the same as utilized during the polishing of the remaining interior floor slab.
 - 2. Polishing Process Timing: The polishing process and additional application of penetrating densifier sealer shall take place a minimum of 28 days after the final cast of the interior floor slab, or later in the project sequence, but prior to construction completion / final punch list by owner.
 - 3. Clean floor slab. Note: It is imperative that the floor is entirely and absolutely clean prior to proceeding with the next step.
 - 4. Polishing Operation (First Pass): Using equipment with sufficient head pressure (≥ 150 psi), polish concrete floor with 200 grit diamond tooling (not pads) in both directions. Each pass must overlap 50% of the previous pass. Polish the concrete floor at a rate to allow for an even scratch pattern. Clean floor thoroughly after this pass.
 - 5. Polishing Operation (Second Pass): Using equipment with sufficient head pressure (≥ 150 psi), polish concrete floor with 400 grit diamond tooling (not pads) in both directions. Each pass must overlap 50% of the previous pass. Polish the concrete floor at a rate to allow for an even scratch pattern. Clean floor thoroughly after this pass.
 - 6. Polishing Operation (Third Pass): Using equipment with sufficient head pressure (≥ 150 psi), polish concrete floor with 800 grit diamond tooling (not pads) in both directions. Each pass must overlap 50% of the previous pass. Polish the concrete floor at a rate to allow for an even scratch pattern. Clean floor thoroughly after this pass.
 - 7. Polishing Operation (Final Pass): Using equipment with sufficient head pressure (≥ 150 psi), polish concrete floor with 1500 grit diamond tooling (not pads) in both directions. Each pass must overlap 50% of the previous pass. Polish the concrete floor at a rate to allow for an even scratch pattern. Clean floor thoroughly after this pass.
 - 8. Liquid Densifier/Sealer: Immediately following final polishing process, provide a second application of liquid penetrating/sealer at 700 sq. ft. /gallon. This shall constitute as the second and final application of liquid densifier/sealer. Buff floor surface with at least one pass of a diamond impregnated buffing pad to achieve the desired appearance. Completely clean floor of any remaining residue.

9. Polish Results: Polish concrete surface to produce Specified Overall Gloss Value (SOGV) ≥ 30 and Minimum Local Gloss Value (MLGV) ≥ 25 as measured using a Horiba IG-320 Gloss Checker.

END OF SECTION 03351

SECTION 06100 - ROUGH CARPENTRY

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 DESCRIPTION OF WORK:

- A. Extent of rough carpentry work is shown on drawings, including schedules, notes and details.
- B. Definitions: Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

1.3 SUBMITTALS:

- A. Material Certificates: Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in form of a signed copy of applicable portion of lumber producer's grading rules showing design values for selected species and grade. Design values shall be as approved by the Board of Review of American Lumber Standards Committee.
- B. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.
 - 1. Preservative Treatment: For each type specified, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and conformance with applicable standards.
 - 2. For water-borne preservatives, include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
 - 3. Fire-Retardant Treatment: is not to be used.

1.4 PRODUCT HANDLING:

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber, as well as plywood and other panels, provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
 - 1. For lumber and plywood pressure treated with waterborne chemicals, sticker between each course to provide air circulation.

1.5 PROJECT CONDITIONS:

- A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other work.

PART 2 – PRODUCTS

2.1 LUMBER, GENERAL:

- A. Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:
 - 1. NLGA - National Lumber Grades Authority (Canadian)
 - 2. SPIB - Southern Pine Inspection Bureau.
 - 3. WCLIB - West Coast Lumber Inspection Bureau.
 - 4. WWPAA - Western Wood Products Association.

- C. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
 - 1. For exposed lumber apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

2.2 MISCELLANEOUS LUMBER:

- A. General: Provide wood for support or attachment of other work including bucks, nailers, blocking, furring, grounds, stripping, and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:
- B. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- C. Grade: Standard Grade light framing size lumber of any species or board size lumber as required. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 2 boards per SPIB rules.

2.3 CONSTRUCTION PANELS:

- A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood panels and, for products not manufactured under PS 1 provisions, with American Plywood Association (APA) "Performance Standard and Policies for Structural-Use Panels", Form No. E445.
- B. Trademark: Factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.
- C. Concealed APA Performance-Rated Panels: Where construction panels will be used for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements indicated for grade designation, span rating, exposure durability classification, edge detail (where applicable) and thickness.
 - 1. Fascia Blocking: APA RATED SHEATHING.
 - a. Exposure Durability Classification: EXTERIOR.
 - b. Span Rating: As required to suit stud spacing indicated.
 - c. Thickness: As indicated.
 - 2. Plywood Backing Panels: For mounting electrical or telephone equipment, plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or, if not otherwise indicated, not less than 15/32".

2.4 MISCELLANEOUS MATERIALS:

- A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices.
 - 1. Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).

2.5 WOOD TREATMENT BY PRESSURE PROCESS:

- A. Preservative Treatment: Where lumber or plywood is indicated as "Treated," or is specified herein to be treated, comply with applicable requirements of AWPB Standards (AWPA C2 for lumber and AWPA C9 for plywood) and AWPB Standards. Mark each treated item with the AWPB Quality Mark Requirements.
 - 1. Pressure-treat with water-borne preservatives. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:
 - a. Wood, nailers, curbs, blocking, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 2. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.
 - 3. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
 - a. Ammoniacal, or amine, copper quat (ACQ).
 - b. Copper bis (dimethyldithiocarbamate) (CDDC).
 - c. Ammoniacal copper citrate (CC).
 - d. Copper azole, Type A (CBA-A).
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
- E. Preservative: Wood nailers, sheathing, curbs, equipment support bases, blocking, and similar members in connection with roofing and flashing or in contact with masonry or concrete.

2.6 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (ply-wood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
 - 2. Use treatment that does not promote corrosion of metal fasteners.
 - 3. Use Exterior type for exterior locations and where indicated.
 - 4. Use Interior Type A High Temperature (HT), unless otherwise indicated.
- B. Application: Fire treat rough carpentry concealed within building construction, rough carpentry exposed to non-ducted return ceiling plenums; and elsewhere as indicated on drawings.

2.7 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than ½ inch thick.

PART 3 EXECUTION**3.1 INSTALLATION, GENERAL:**

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. CABO NER-272 for power-driven fasteners.
 - 2. Published requirements of metal framing anchor manufacturer.
 - 3. Table 23-II-B-1, "Nailing Schedule", and Table 23-II-B-2 "Wood Structural Panel Roof Sheathing Nailing Schedule", in the Uniform Building Code.
 - 4. Table 2305.2, "Fastening Schedule", in the BOCA National Building Code.
 - 5. Table 2306.1, "Fastening Schedule", in the Standard Building Code.
 - 6. Tables per section 2304 in the International Building Code.
- D. Wood blocking used in conjunction with the installation of roofing systems, flashing and sheet metal, roof specialties and accessories, and roof top mechanical equipment shall comply with (NRCA) National Roofing Contractors Association " and (FMG) Factory Mutual Global Installation Standards.
 - 1. Reference the roofing system specification section for required FM rating.
- E. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood, pre-drill as required.
- F. All fasteners and specialty anchors used for anchorage of preservative treated wood blocking or plywood panels shall be rated to resist corrosion per the type of treated material provided.
 - 1. All treated wood blocking and plywood shall be installed using stainless steel screws or double dipped galvanized nails rated for use with the treated material installed.

3.2 WOOD, NAILERS, AND BLOCKING:

- A. Provide wherever shown and where required for attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to form work before concrete placement.

3.3 INSTALLATION OF CONSTRUCTION PANELS:

- A. General: Comply with applicable recommendations contained in Form No. E 30K, "APA Design/Construction Guide - Residential & Commercial", for types of construction panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Combination Subflooring-Underlayment: Glue-nail to framing.
 - 2. Plywood Backing Panels: Screw to steel Supports.

END OF SECTION 06100

SECTION 06400 - ARCHITECTURAL WOODWORK

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 DESCRIPTION OF WORK:

- A. Extent of each type of architectural woodwork including related materials or products is shown on drawings including, schedules, notes and details.
- B. Definitions: Architectural woodwork includes woodwork of stock and specially fabricated work in a woodworking plant which is exposed to view, is non-structural and is not specified as part of other sections.

1.3 SUBMITTALS:

- A. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.
- B. Samples: Submit the following samples:
 - 1. Plastic laminate, for each type, color, pattern and finish.
 - 2. Exposed cabinet hardware, one unit of each type and finish.

1.4 QUALITY ASSURANCE:

- A. AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI), except as otherwise indicated.
- B. Installer Qualifications: Arrange for installation of architectural woodwork by a firm with minimum of 5 years experience which can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.
- C. MDF board is not acceptable.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.
- B. Do not deliver woodwork, until painting, wet work, grinding, and similar operations which could damage, soil, or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1.6 PROJECT CONDITIONS:

- A. Conditioning: Woodwork Manufacturer and Installer shall advise Contractor of temperature and humidity requirements for woodwork installation and storage areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.
- B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. Require Woodwork Manufacturer to establish optimum moisture content and required temperature and humidity conditions.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide architectural woodwork products of one of the following.
 - 1. High Pressure Decorative Laminate:
 - a. Formica Corp: Basis of Design.
 - b. Ralph Wilson Plastics Co.
 - c. Nevamar Corp.

2.2 MATERIALS:

- A. General: Provide materials that comply with requirements of the AWI Woodworking standard for each type of woodwork and quality grade indicated.

2.3 FABRICATION, GENERAL:

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.
- B. Fabricate woodwork to dimensions, profiles, and details indicated with openings and mortises precut, where possible, to receive hardware and other items and work.
 - 1. Ease edges to a 1/16" radius, for corners of cabinets and edges of solid wood (lumber) members less than 1" in nominal thickness, 1/8" radius for edges of rails and similar members over 1" in nominal thickness.
- C. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Pre-Cut Openings: Fabricate architectural woodwork with pre-cut openings, where possible. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutouts and, where located in countertops and similar exposures seal edges of cutouts with a water-resistant coating.
 - 1. Cutouts: Fabricate cutouts in tops to accommodate cable penetrations and service outlets, if any. Comply with requirements indicated for size, shape, number, and location.
 - a. Fit cutouts with manufacturer's standard grommets in sizes indicated or, where size of cutouts exceed maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding having tapered top flange.
 - i. Furnish removable covers for grommets.
- E. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.
 - 1. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

2.4 ARCHITECTURAL CABINETS, LAMINATE CLAD:

- A. Quality Standard: Comply with AWI Section 400 and its Division 400B.
- B. Laminate Clad Cabinets: Comply with the following requirements:
 - 1. Grade: Premium.
 - 2. Type of Cabinet Construction: As detailed.
 - 3. Laminate Cladding: High pressure decorative laminate complying with NEMA LD 3 and as follows:
 - a. Colors, Patterns, and Finishes: As indicated or if not otherwise indicated, as selected by Architect from laminate manufacturer's standard products.
 - 4. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.
 - a. Horizontal Surfaces Other Than Tops: GP-50 (0.050" nominal thickness).
 - b. Vertical Surfaces: GP-28 (0.028" nominal thickness).
 - c. Edges: GP-28 (0.028" nominal thickness).
 - 5. Semi-Exposed Surfaces: Provide surface materials indicated below:
 - a. High pressure laminate, GP-28.
 - 6. Concealed Surfaces: Provide balancing sheet overlay - .020 min. phenolic backer.

2.5 CABINET HARDWARE AND ACCESSORY MATERIALS:

- A. General: Unless otherwise noted on the drawings, provide the following cabinet hardware and accessory materials associated with architectural cabinets, except for items which are specified in Division-8 section "Finish Hardware".
- B. Cabinet Hardware Schedule:
 - 1. Hinges: Semi-adjustable, concealed hinge, 270 degree swing, as manufactured by Amerock or Julius Blum.
 - 2. Pulls: Wire projecting type, drilling 4" on center, #4483 or equal as manufactured by Stanley.
 - 3. Drawer Glides: Side and bottom mounted slides with positive stop and lockout position, with heavy-duty full extension; #1429 or equal as manufactured by Knappe & Vogt.
 - 4. Shelf Supports and Standards: Adjustable shelf supports constructed of high impact injection molded nylon and with heavy duty twin slotted shelving standards as produced by Knappe & Vogt or equal.
- C. Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware".
- D. Hardware Finishes: Comply with BHMA 1301 for finishes indicated by BHMA Code Numbers or if not otherwise indicated, provide finishes complying with requirements indicated below:
 - 1. For exposed hardware comply with requirements indicated for finish and base indicated by BHMA Code Number or US Code number indicated on drawings.
 - 2. For concealed hardware provide manufacturer's standard finish which complies with product class requirements of ANSI/BHMA A156.9.

2.6 ARCHITECTURAL CABINET TOPS, VANITIES AND COUNTERS AND WINDOW STOOLS:

- A. Quality Standard: Comply with AWI Section 400 and its Division 400C.
- B. Type of Top: High-pressure Decorative Laminate:
 - 1. Grade: Premium
 - 2. Laminate Cladding for Horizontal Surface: High-pressure decorative laminate complying with NEMA LD 3 and as follows:
 - a. Colors, Patterns, and Finishes: As indicated or, if not otherwise indicated, as selected from laminate manufacturers' standard products.
 - b. Grade: GP-50 (0.050" nominal thickness).

3. Edge Treatment: Same as laminate cladding on horizontal surfaces.
4. All substrate material to be plywood.

2.7 SHELVING:

- A. Quality Standard: Comply with AWI Section 600.
- B. Shelving for High Pressure Decorative Laminate Finish: Comply with the following requirements.
 1. Grade: Custom.
 2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate complying with NEMA LD3 and as followings:
 - a. Colors, Patterns, and Finishes: As indicated or, if not otherwise indicated, as selected from laminate manufacturer's standard products.
 - b. Grade: GP-50 (0.050" nominal thickness)
 3. Edge Treatment: Same as laminate cladding on horizontal surfaces.
 4. All substrate material to be plywood.

2.8 SHELVING HARDWARE:

- A. Adjustable Shelf Standards and Related Supports: Provide standards and supports of type indicated which comply with ANSI/BHMA A156.9.
 1. Vertical Slotted Type: Vertical slots spaced 2" on center, 7/8" wide x 11/16" high x length indicated, BHMA No. B84102, zinc-plated steel.
 2. Shelf Brackets: Size required to support shelving widths indicated, BHMA No. B84112, zinc-plated steel.

2.9 FASTENERS AND ANCHORS:

- A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.
 1. For metal framing supports, provide screws as recommended by metal framing manufacturer.
- B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inserts as required for corrosion-resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

PART 3 – EXECUTION

3.1 GENERAL:

- A. Quality Standards: Comply with AWI Section 1700, unless otherwise indicated.

3.2 PREPARATION:

- A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.
- B. Pre-Installation Meeting: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor; Architect and other Owner Representatives (if any); Installers of architectural woodwork, wet work such as plastering, other finishes, painting, mechanical work and electrical work; and firms or persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with woodwork installation only when everyone concerned agrees that required ambient conditions can be maintained.
- C. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.

- D. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.3 INSTALLATION:

- A. Install woodwork plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.
- B. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- C. Anchor woodwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fasteners heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.
- D. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish.
- E. Tops: Anchor securely to base units and other support systems as indicated.
- F. Shelving: Complete the assembly of units and install in the areas indicated, including hardware and accessories as indicated.

3.4 ADJUSTMENT, CLEANING, FINISHING, AND PROTECTION:

- A. Repair damaged and defective woodwork wherever possible to eliminate defects functionally and visually; where not possible to repair replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.
- D. Complete the finishing work specified as work of this section, to whatever extent not completed at shop or prior to installation of woodwork.
- E. Provide final protection and maintain conditions, in a manner acceptable to Fabricator and Installer, which ensures architectural woodwork being without damage or deterioration at time of substantial completion.

END OF SECTION 06400

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SECTION 07210 - BUILDING INSULATION

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 DESCRIPTION OF WORK:

- A. Extent of building insulation work is shown on drawings and indicated by provisions of this section.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's product literature and installation instructions for each type of insulation and vapor retarder material required.

1.4 QUALITY ASSURANCE:

- A. Thermal Resistivity: Where thermal resistivity properties of insulation materials are designated by r-values they represent the rate of heat flow through a homogenous material exactly 1" thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.
- B. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Surface Burning Characteristics: ASTM E 84.
 - 2. Fire Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.
- C. Environmental Standards: Plastic foam insulation shall comply with provisions of the following:
 - 1. Environmental Protection Agency (EPA) requirements on the elimination of chlorofluorocarbons (CFC's) blowing agent.
 - 2. Only plastic foam insulation using alternative blowing agent complying with Environmental Protection Agency (EPA) requirements on Volatile Organic Compounds (VOC) shall be used; unless the manufacturer is tax exempt.
- D. Reference Standards:
 - 1. ASTM C 612-99 "Standard Specification for Mineral Fiber Block and Board Thermal Insulation."
 - a. Product provided under ASTM C612-93 shall be provided with a "delivered" density equal to that of the "specified" density.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. General Protection: Protect insulation from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.
- B. Protection for Plastic Insulation:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time section title.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Manufacturers of Extruded Polystyrene Board Insulation:
 - a. Dow Chemical U.S.A Styrofoam SM.
 - b. Owens-Corning Formular 250.
2. Manufacturers of Polyisocyanurate Board Insulation:
 - a. Celotex.
 - b. Manville Corp.
3. Manufacturers of Glass Fiber Insulation:
 - a. Manville Corp.
 - b. Owens-Corning Fiberglas Corp.
4. Manufacturers of Semi-Refractory Fiber Insulation:
 - a. Manville Corp.
 - b. United States Gypsum Co.
5. Manufacturers of Foam Insulation:
 - a. cfiFOAM, Inc.Knoxville, TN,
 - b. Tailored Chemical Products, Inc. (Core-Fill-500), Hickory, NC
 - c. Thermal Corp. of America (Thermco), Mt Pleasant, IA.
 - d. Polymaster, Inc. (R-501), Knoxville, TN

2.2 INSULATING MATERIALS:

- A. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.
1. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths and lengths.
- B. Extruded Polystyrene Board Insulation: Rigid, cellular thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578 for Type indicated; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg.F (4.4 and 23.9 deg.C), respectively; and as follows:
1. Type IV, 1.6 lb./cu. ft. min. density, unless otherwise indicated.
 2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 5 and 165, respectively.
- C. Polyisocyanurate Board Insulation: Comply with the requirements of Specification Sections 07502 and 07542.
- D. Unfaced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing); and as follows:
1. Mineral Fiber Type: Fibers manufactured from glass.
 2. Combustion Characteristics: Passes ASTM E 136 test.
 3. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.
- E. Unfaced Mineral Fiber Sound Attenuation Blanket-Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C665 for Type I (blankets without membrane facing); and as follows:
1. Mineral Fiber Type: Fibers manufactured from glass.
 2. Combustion Characteristics: Passes ASTM E 136 test.

3. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.
- F. Foam Insulation: Standard two (2) component system consisting of a resin and catalyst; nominal density of 1.1 lbs. per cu. ft; thermal conductivity ASTM C-177, R-value of 4.6 at 75 deg. F; water vapor transmission ASTM C-355, perms-in 15.5 to 16.9; and as follows:
 1. Surface Burning Characteristic: ASTM E-84 flame spread 25, smoke development 50, and fuel contribution 0.

2.3 AUXILIARY INSULATING MATERIALS:

- A. Polyethylene Vapor Retarder: ASTM D 4397, 6-mil polyethylene film, with laboratory-tested vapor transmission rating of 0.2 perms, natural color.
- B. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer, and complying with requirements for fire performance characteristics.
- C. Mechanical Anchors: Type and size indicated or, if not indicated as recommended by insulation manufacturer for type of application and condition of substrate.
- D. Insulation / Finish Board Accessories: Provide manufacturer's recommended accessories for attachment to proposed substrate and panels with shiplap edge joint.
- E. Insulation Supports: Provide insulation supports of the type required to hold insulation into its intended location for the life of the installation.
 1. 13 Gage carbon steel wire with chisel cut ends.
 2. Other products as required to suit particular installation requirements

PART 3 – EXECUTION

3.1 INSPECTION AND PREPARATION:

- A. Require Installer to examine substrates and conditions under which insulation work is to be performed. A satisfactory substrate is one that complies with requirements of the section in which substrate and related work is specified. Obtain Installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.
- B. Clean substrates of substances harmful to insulation or vapor retarders, including removal of projections which might puncture vapor retarders or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL:

- A. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.
- B. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
- C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF PERIMETER INSULATION:

- A. On vertical surfaces, set extruded polystyrene board insulation in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of insulation.

3.4 INSTALLATION OF UNDER-SLAB INSULATION:

- A. On horizontal surfaces of depressed slabs where insulated floor is shown on drawings, set extruded polystyrene board insulation in accordance with manufacturer's instructions.

3.5 INSTALLATION OF SOUND ATTENUATION INSULATION:

- A. Ceiling Plenum: Apply sound attenuation insulation in ceiling plenum from top of ceiling to bottom of structure above to provide sound transmission barrier. Cut, fit and tape around all penetrations. Attach in place using mechanical anchorage to provide permanent placement and support of insulation.
- B. Suspended Ceiling: Set sound attenuation insulation on top of ceiling panels of suspended ceiling, extend insulation 4'-0" from each side of partition terminated at ceiling.

3.6 INSTALLATION OF GENERAL BUILDING INSULATION:

- A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between closed-cell (non-breathing) insulation units by applying mastic or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with mastic or sealant.
- C. Stuff loose glass fiber installation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40% of normal maximum volume (to a density of approximately 2.5 lbs. per cu. ft.)

3.7 INSTALLATION OF VAPOR RETARDERS:

- A. General: Install vapor barrier inside all fibrous insulation and inside rigid insulation which is applied to inside surfaces of exterior walls. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those which have been stuffed with loose fiber-type insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end and bottom edges, at perimeter of wall openings and at lap joints; space fasteners 16" o.c.
- C. Seal overlapping joints in vapor retarders with adhesives per vapor retarder manufacturer's printed directions. Seal butt joints and fastener penetrations with tape of type recommended by vapor retarder manufacturer. Locate all joints over framing members or other solid substrates. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.
- D. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with cloth or aluminized tape of type recommended by vapor retarder manufacturer to create an air-tight seal between penetrating objects and vapor retarder.
- E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with tape or another layer of vapor retarder.

3.8 PROTECTION:

- A. General: Protect installed insulation and vapor retarders from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

END OF SECTION 07210

CONFORMANCE SUBMITTAL
Section 07210 – Building Insulation (Extruded- Polystyrene Board Insulation)

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name, Phone Number)

(Address)

Sub-Contractor: _____
(Company Name, Phone Number)

(Address)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Extruded-Polystyrene Board Insulation:

- ☐ Styrofoam SM by Dow Chemical Company.
- ☐ Formula 250 extruded polystyrene by UC Industries.

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL**Section 07210 – Building Insulation (Faced, Unfaced and Sound Attenuation Fiber Glass Batt Insulation)**

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name, Phone Number)

(Address)

Sub-Contractor: _____
(Company Name, Phone Number)

(Address)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Faced, Unfaced and Sound Attenuation Fiber Glass Batt Insulation:

- ☐ Johns Manville.
- ☐ Owens-Corning.

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL
Section 07210 – Building Insulation (Foam Filled Insulation)

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name, Phone Number)

(Address)

Sub-Contractor: _____
(Company Name, Phone Number)

(Address)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Foam Filled Insulation:

- ☐ Tailored Chemical Products, Inc. (Core-Fill-500).
- ☐ Thermal Corp. of America (Thermco).
- ☐ Polymaster (501).
- ☐ cfiFOAM, Inc.

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor:

(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

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SECTION 07542 - TPO ROOFING SYSTEM-MECHANICALLY ATTACHED

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 DESCRIPTION OF WORK:

- A. Extent of flexible sheet roofing (FSR) is indicated on drawings and is hereby defined to include non-traffic-bearing sheet membrane system intended for weather exposure as primary roofing.

1.3 DEFINITIONS:

- A. Thermal Resistivity: Where thermal resistivity properties of insulating materials are designated by R values, they represent the rate of heat flow through a homogenous material exactly 1" thick, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.
- B. Thermal Resistance: Where thermal resistance properties of insulating materials are designated by R-values they represent the rate of heat flow through a material of thickness indicated, measured by test method included in referenced material standard or otherwise indicated. They are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.
 - 1. Combustibility Characteristics: ASTM E 136.
- C. Environmental Standards: Plastic foam insulation shall comply with provisions of the following:
 - 1. United Nation Environmental Program (UNEP) and Environmental Protection Agency (EPA) requirements on the elimination of chlorofluorocarbons (CFC's) blowing agent.
 - 2. Only plastic foam insulation using alternative blowing agent complying with Environmental Protection Agency (EPA) requirements on Volatile Organic Compounds (VOC) shall be used; unless the manufacturer is tax exempt.

1.4 SUBMITTALS:

- A. Product Data: Submit specifications, installation instructions and general recommendations from manufacturers of flexible sheet roofing system materials, for types of roofing required. Include data substantiating that materials comply with requirements.
- B. Shop Drawings: Submit complete shop drawings showing roof configuration, sheet layout, seam locations, colors (as applicable), details at perimeter, and special conditions.
 - 1. Indicate layout of tapered insulation materials.
- C. Pre-Roofing Conference: Submit copies of pre-roofing conference records.

1.5 APPROVED MANUFACTURERS

- A. Lowe's has secured National Account pricing and 20 year warranty agreement with the following manufacturer's:
 - 1. GAF
 - a. Primary Contact: Michelle Carlin, National Accounts Manager, Charleston, SC. Phone: 973.832.6979
 - b. Secondary Contact: Chris Yeatts, Vice President National Accounts, Dallas, TX. Phone: 972.851.0419
 - 2. Johns Manville
 - a. Primary Contact: Brian Simon, Preferred Accounts Manager, Phone 609.495.7437 Email: brian.simon@JM.com
 - b. Secondary Contact: Megan Keyes, Phone: 713.834.5600 Email: megan.keyes@jm.com

3. Firestone

- a. Primary Contact: David Finn, Director of Corporate Accts, Phone: 413.636.5695. Email: dfinn@firestonebp.com

4. Carlisle SynTech Systems

- a. Primary Contact: Janail Mack, National Manager Consulting Services, 1295 Ritner Highway, Carlisle, PA 17103 Phone: 717.245.7393 Email: janail.mack@carlisleccm.com
- b. Secondary Contact: Steve Benjamin, SA Technical Manager, Phone: 413.262.8928. Email: steven.benjamin@carlisesyntec.com

1.6 QUALITY ASSURANCE:

- A. Manufacturer: Obtain primary flexible sheet roofing from a single manufacturer. Provide secondary materials as recommended by manufacturer of primary materials.
- B. Installer: A firm with not less than 5 years of successful experience in installation of roofing systems similar to those required for this project and which is acceptable to or licensed by manufacturer of primary roofing materials.
 1. Work associated with flexible sheet roofing, including (but not limited to) vapor retarders, insulation, flashing and counterflashing, expansion joints, and flexible sheet joint sealers, is to be performed by Installer of flexible sheet roofing.
- C. Pre-Roofing Conference: Contractor shall have a pre-installation conference one (1) week prior to commencing work on this section. Notify Owner at least two (2) weeks in advance of this date. Required attendees will be Roof Installer, Deck Installers, General Contractor, Roofing Manufacturer's Technical Representative, and Owner. The agenda shall include:
 1. Where possible, tour representative areas of roofing substrates (decks), and discuss substrate condition.
 2. Review contract documents, submittals, status of coordinating work, availability of materials and installation facilities, proposed installation schedule, requirements for inspections and testing or certification, forecasted weather conditions, governing regulations, insurance requirements, and proposed installation procedures.
 3. Record discussion including agreement or disagreement on matters of significance; furnish copy of recorded discussions to each participant.
 4. Discuss roofing system protection requirements for construction period extending beyond roofing installation. If meeting ends with substantial disagreements, determine how disagreements will be resolved and set date for reconvened meeting.
- D. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification necessary in connection with fire and extended coverage insurance on roofing and associated work.
- E. FM Listing: Provide labeled materials that have been tested and listed by FM in "Factory Mutual Approval Guide" for application indicated.
- F. UL Listing: Provide labeled materials which have been tested and listed by UL in "Building Materials Directory" for application indicated, with "Class A" rated materials/system for roof slopes shown.
- G. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Surface Burning Characteristics: ASTM E 84.
 2. Fire Resistance Ratings: ASTM E 119.
 3. Combustion Characteristics: ASTM E 136.

1.7 PROJECT CONDITIONS:

- A. Weather: Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

1.8 SPECIAL PROJECT WARRANTY: This section needs to be reviewed.

- A. Provide written warranty, signed by Manufacturer of primary roofing materials and his authorized Installer, agreeing to replace/ repair defective materials and workmanship as required to maintain roofing system in watertight condition. Warranty shall also cover performance in cold weather conditions in the area
 - 1. Warranty period is 15 years after date of substantial completion.
- B. The roofing system written warranty shall reflect the required design wind speed and FM wind uplift rating within the document.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Performance: Provide roofing materials recognized to be of generic type indicated and tested to show compliance with indicated performances, or provide other similar materials certified in writing by manufacturer to be equal or better than specified in every significant respect, and acceptable to Architect.
- B. Compatibility: Provide products which are recommended by manufacturers to be fully compatible with indicated substrates, or provide separation materials as required to eliminate contact between incompatible materials.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE SYSTEM:

- A. Contractor shall furnish and install a complete roofing system that is a mechanically fastened reinforced TPO. The roofing manufacturer shall furnish all TPO elastomeric sheet roofing, roof insulation, walk pads, fastening plates, sealants, flashing, tapes, bonding adhesives, and all accessories necessary for a complete insulated elastomeric sheet roofing system.
 - 1. System shall be tested and approved for FM I-90 wind uplift rating and 90 mph wind speed. Adjust FM rating per Lowe's insurance underwriter requirements.
 - 2. System shall be designed and installed in accordance with local and state codes.
 - 3. In addition to all items required in 1.04 Submittals, at time of bid submit physical properties of the TPO membrane including, but not limited to:

a. Brittleness Point:	in degrees Fahrenheit
b. Breaking strength	ASTM D 751
c. Tearing Strength	ASTM D 751
d. Ozone Resistance	ASTM D 1149
e. Resistance to heat aging	ASTM D 573
f. Water Absorption	ASTM D 471
g. Linear Dimension Change:	ASTM D 1204
- B. Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally reinforced.
 - 1. Minimum, .060 inch thick, reinforced.
 - 2. Color as noted on the Bid Form or as selected by the Architect from Manufactures standard colors.
- C. Manufacturers and Systems:
 - 1. Ultraply TPO Mechanically Anchored Roofing System; Firestone Building Products
 - 2. Sure-Weld TPO Mechanically Fastened Roofing System; Carlisle SynTec Inc.
 - 3. Everguard TPO, GAF Materials Corporation
 - 4. Johns Mansville TPO, Johns Mansville

2.3 AUXILIARY MATERIALS FOR FSR:

- A. Sheet Seaming System: Automatic hot-air welder.
- B. Cant Strips, Tapered Edge Strips and Flashing Accessories: Types recommended by manufacturer of TPO material, provided at locations indicated and at locations recommended by mfr., including adhesive tapes, flashing cements, and sealants.
- C. Flashing Material: Manufacturer's standard system compatible with flexible sheet membrane.
- D. Walkway Protection: Provide walkway pads designed specifically for protection of exposed TPO membrane. Provide pads at locations shown and where required for service access to roof mounted equipment and for roof access areas.
- E. Mechanical Fasteners: Metal plates, caps, battens, accessory components, fastening devices and adhesives to suite substrate as recommended by membrane manufacturer.
 - 1. Provide system tested and approved for FM I-90 wind uplift rating and 90 mph wind speed. Adjust FM rating per Lowe's insurance underwriter requirements.
 - 2. All fasteners and specialty anchors used for anchorage of the roofing system to preservative treated wood shall be rated to the resist corrosion for the type of treated material installed.

2.4 INSULATING MATERIALS:

- A. General: Provide insulating materials to comply with requirements indicated for materials and compliance with referenced standards; in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths and lengths.
 - 1. Approved Insulation: Provide only insulating materials produced by manufacturer's as listed by FM in "Factory Mutual Approval Guide" and as approved by FSR manufacturer for system indicated.
- B. Polyisocyanurate Board Roof Insulation: Rigid, cellular thermal insulation with polyisocyanurate closed-cell foam core and manufacturer's standard facing laminated to both sides; complying with ASTM C 1289-95 Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board and FS HH-I-1972/2, Class 1; aged
- C. R-values as designated at mean temperatures indicated and as follows:
 - 1. Surface Burning Characteristics: Maximum flame spread of 25.
 - 2. Thermal Resistivity: 5.6 at 75 deg F (23.9 deg C) for 1" thick insulation board.
 - 3. Provide tapered boards where indicated for sloping to drain; fabricate with taper as indicted per ft. in the 24" dimension.
 - 4. Compressive Strength: 20 psi per ASTM D 1621-94 Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 5. Dimensional Stability: Less than 2.0 percent change in length, width and thickness per ASTM D 2126-94 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- D. Extruded Polystyrene Board Insulation: Rigid, cellular thermal insulation with closed cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578 for Type indicated; with 5-year aged r-values of 5.4 and 5 at 40 and 75 deg F (4.4 and 23.9 deg C), respectively; and as follows:
 - 1. ASTM C 578-92 Type X – 15 psi minimum compressive strength.
 - 2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 75 and 450, respectively.
 - 3. Provide tapered boards where indicated for sloping to drain; fabricate with taper of 1/4" per ft. in the 24" dimension.
 - 4. Product: "Styrofoam Deckmate"; Dow Chemical Co.
- E. Tapered Insulation Systems: Only polyisocyanurate or extruded polystyrene acceptable.

2.5 AUXILIARY INSULATION MATERIALS:

- A. Mechanical Anchors: Corrosion-resistant type as recommended by insulation manufacturer for deck type, and complying with fire and insurance uplift rating requirements.
 - 1. Provide system tested and approved for FM I-90 wind uplift rating and 90 mph wind speed. Adjust FM rating per Lowe's insurance underwriter requirements.

PART 3 – PRODUCTS

3.1 PREPARATION OF SUBSTRATE:

- A. General: Comply with manufacturers' instructions for preparation of substrate to receive FSR system.
- B. Inspection of Surfaces
 - 1. Clean substrate of dust, debris, and other substances detrimental to FSR system work. Remove sharp projections.
 - 2. Examine surfaces for adequate anchorage, foreign materials, moisture, and other conditions which would adversely affect the roofing application and performance.
 - 3. The roofing contractor shall be responsible for preparing adequate surfaces to receive insulation, roofing, and flashing.
- C. Install cant strips, flashings, and accessory items as shown, and as recommended by manufacturer even though not shown.

3.2 INSTALLATION:

- A. General: Comply with manufacturers' instructions, except where more stringent requirements are indicated.
- B. On steel decks, comply with UL requirements for "Roof Deck Constructions" which are rated "Fire Acceptable" or comply with FM requirements for "Class I" metal deck construction.

3.3 INSULATION INSTALLATION:

- A. Extend insulation full thickness, in two layers, over entire surface to be insulated, as indicated on drawings cutting and fitting tightly around obstructions. Form cant strips, crickets, saddles, and tapered areas with additional material as shown and as required for proper drainage of membrane.
 - 1. Stagger joints a minimum 12 inches in both directions from first course with no gaps to form a complete thermal envelope.
- B. Do not install more insulation each day than can be covered with membrane before end of day and before start of inclement weather.
- C. Secure roof insulation to substrate with mechanical anchors of type and spacing indicated; but in no case provide less than one anchor per 4 square feet of surface area, or less anchorage than required by FM "Loss Prevention Data Sheet 1-28".

3.4 MEMBRANE INSTALLATION:

- A. General: Start installation only in presence of manufacturer's technical representative.
- B. Mechanically Fastened Membrane: Install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer, and bonding and sealing seam. Install mechanical fasteners at spacing recommended by manufacturer, covering with adhesive-applied membrane so that no fasteners are exposed. Install flashings and counterflashings as shown or recommended by manufacturer.
 - 1. Follow manufacturer's instructions for non-penetrating mechanically fastened systems.
 - 2. Mechanically fastened field membrane sheets shall be sized and installed in accordance with wind load requirements, and local and state codes. Maximum spacing between rows of fasteners shall be 10'-0" and maximum spacing of fasteners for membranes measuring from 80 inches to 120 inches shall be 12" center to center.

3. Contractor shall assure that the splicing system is installed in strict accordance with the manufacturer's requirements given the actual field conditions. Complete sealing of all splices by the end of each work day. Care should be exercised at the end of each work day to ensure that water does not flow beneath completed sections of roofing system.
- C. Walkway Protection: Install walkway pads at locations shown and where required for access to roof-mounted equipment. Walk pads to be hot air welded or adhered to the roof membrane per manufacturer's recommendations.

END OF SECTION 07542

SECTION 07600 - FLASHING AND SHEET METAL

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 DESCRIPTION OF WORK:

- A. Extent of flashing and sheet metal work is indicated on drawings and by provisions of this section.

1.3 SUBMITTALS

- A. Product data: Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.
- B. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counter-flashings, trim/fascia units, gutters, downspouts, scuppers, copings, and expansion joint systems. Provide layouts at 1/4 inch scale and details at 3 inch scale.
- C. Samples of sheet metal flashing, trim, and accessory items to be exposed as finished surfaces, in the specified finish. Where finish involves normal color and texture variation, include sample sets composed of 2 or more units showing the full range of variations expected.

1.4 PROJECT CONDITIONS

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.5 QUALITY CONTROL:

- A. Standards: Procedures not covered by this section shall be as recommended by the following association and shall become part of this section as if specified.
 - 1. National Roofing Contractors Association (NRCA) "Roofing and Waterproofing Manual."
 - 2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "Architectural Sheet Metal Manual.- 5th addition."
- B. Environmental Standards: Fluorocarbon coating materials shall comply with provisions of the following; as soon as one of the manufacturers develop a compliant products.
 - 1. Environmental Protection Agency (EPA) requirements for less than 350 grams per liter of Volatile Organic Compounds (VOC).

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Prefinished Coils: Subject to compliance with requirements, provide products of one of the following or an approved equal:
 - 1. Copper Sales, Inc.
 - 2. Peterson Aluminum Corporation.
 - 3. Vincent Metals.

2.2 SHEET METAL FLASHING AND TRIM MATERIALS

- A. Aluminum: ASTM B209 alloy 3003, temper H14.
 - 1. Provide .063 thick prefinished aluminum for all 12" gutters and .050 thick prefinished aluminum for all copings, downspouts, fascia, gravel stops and trim materials on the RDC facility.
 - 2. Provide .040 thick prefinished aluminum gutters, downspouts, fascia, gravel stops and trim materials at the Transportation Center and Pumphouse.
 - 3. Comply with SMACNA standards if above minimum metal gauges do not comply.

B. Miscellaneous Materials and Accessories:

1. Fasteners: Same metal as flashing/sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
2. Bituminous Coating: SSPC - Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
3. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
4. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealers."
5. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.
6. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
7. Paper Slip Sheet: 5-lb. rosin-sized building paper.
8. Polyethylene Underlayment: Minimum 6-mil carbonated polyethylene film; resistant to decay when tested in accordance with ASTM E 154.
9. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
10. Roofing Cement: ASTM D 2822, asphaltic.
11. All fasteners and specialty anchors used for anchorage of flashing and sheet metal to preservative treated wood shall be rated to resist corrosion per the type of treated wood installed or be stainless steel.

2.3 FABRICATED UNITS

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work and to allow for re-roofing without disturbing flashing member by using 2-piece snap-in counter-flashing unit. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates including treated wood by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

2.4 FLASHING AND SHEET METAL UNITS:

- A. General: The following SMACNA "Architectural Sheet Metal Manual - Fifth Edition 1993" Plate Design Numbers are used for reference to assist in the proper fabrication of the designed unit. If painted galvanized bracket provided, add roof membrane separation sheet between bracket and gutter. Adhere and trim so membrane not visible.
 1. Copings: Design - Figure 3-1; Style - Fig. 3-4A; Seams - Figure 3-2, #21 (without fasteners – top cap profile to match coping).

2. Hanger Requirements, Figure 1-12 with gutter brackets, except gutter brackets to be specified as follows: Provide 3/16" thick x 1 1/2" wide stainless steel or 1/4" x 1 1/2" galvanized bar bracket at 36" on center. Stainless steel or galvanized bar bracket to be painted to match gutter.
3. Downspouts: Design - Figure 1-32B, Table 1-9; Hanger - Figure 1-35G.
4. Plain
5. Gravel Stop/Fascia: Fig. 2-1B, seam 2-5C, modified for single ply installation.
6. Counter Flashing System: Design - Figure 4-3D.
7. Splash Pan: Design - Figure 1-36.
8. Penetration Flashing: Design - Figure 4-14.
9. Gutter System: Figure 1-2 style D with Figure 1-7 expansion joint.

2.5 ALUMINUM FINISHES:

- A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. For components, which are assembled or welded in factory, apply finish after fabrication is completed.
 1. Provide colors or color matches as indicated.
 - a. Lowes Medium Beige or as indicated on drawings.
- B. Non-Exposed to view flashing and sheet metal such as counter flashing system, etc.
 1. Mill Finish: AA-M10 (Unspecified mill finish) standard mill finish provided by manufacturer.
- C. Exposed to view flashing and sheet metal such as gutters, downspouts, etc.
 1. High Performance Coating: AA-C12C42R1x (cleaned with inhibitive chemical, conversion coated with an acid-chromate- fluoride-phosphate treatment and painted with organic coating specified below). Apply strict compliance with coating and resin manufacturer's instructions using a licensed applicator.
 - a. Fluorocarbon Coating: Inhibitive thermo-cured primer, 0.2 min. mil dry film thickness, and thermo-cured fluorocarbon coating containing "Kynar 500" resin, 1.0 mil min. dry film thickness.

PART 3 – EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints and seams that will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip-sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install receiver of 2-piece counterflashing in manner and by methods indicated. Where shown in masonry furnish reglets to trades of masonry work, for installation as work of Division 4 sections.
 1. Install counterflashing in receiver by snap-in arrangement

3.2 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.
- B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering at time of substantial completion.

END OF SECTION 07600

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SECTION 07700 - ROOF SPECIALTIES AND ACCESSORIES

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 DESCRIPTION OF WORK:

- A. Extent and locations of roof accessories is indicated on the drawings and by provisions of this section.

1.3 SUBMITTALS:

- A. Product Data; Roof Accessories: Submit manufacturer's technical product data, rough-in diagrams, details, installation instructions and general product recommendations.
- B. Coordination Drawings: Submit coordination drawings. Indicate dimensions and locations of items provided under this section, together with relationships and methods of attachment to adjacent construction.

1.4 QUALITY ASSURANCE:

- 1.5 Standards: Comply with SMACNA "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap- flashing to coordinate with type of roofing indicated. Comply with "NRCA Roofing and Waterproofing Manual" details for installation of units.

PART 2 – PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS:

- A. Provide manufacturers' standard units, modified as necessary to comply with requirements. Shop fabricate each unit to greatest extent possible.

2.2 MATERIALS, GENERAL:

- A. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 525, G90 hot-dip galvanized, mill phosphatized.
- B. Aluminum Sheet: ASTM B 209, alloy 3003, temper as required for forming and performance; AA-C22A41 clear anodized finish, except mill finish prepared for painting where indicated for field painting.
- C. Insulation: Manufacturer's standard rigid or semi-rigid board of glass fiber of thicknesses indicated.
- D. Wood Nailers: Softwood lumber, pressure treated with water-borne preservatives for above-ground use, complying with AWPB LP-2; not less than 1-1/2" thick.
- E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.
 - 1. All fasteners and specialty anchors used for anchorage of the roof specialty or accessory to preservative treated wood shall be rated to resist corrosion for the type of treated material installed or be stainless steel.
- F. Gaskets: Tubular or fingered design of neoprene or polyvinyl chloride, or block design of sponge neoprene.
- G. Bituminous Coating: FS TT-C-494A or SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coating.
- H. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- I. Elastomeric Sealant: Generic type recommended by unit manufacturer, which is compatible with joint surfaces; comply with FS TT-S-00227E, TT-S-00230C, or TT-S-001543A.
- J. Roofing Cement: ASTM D 2822, asphaltic.

2.3 PREFABRICATED ROOF HATCHES:

- A. General: Fabricate units of sizes shown, single-leaf type unless otherwise indicated, for 40 lbs. per sq. ft. external loading and 20 lbs. per sq. ft. internal loading pressure. Frame with 12" high integral-curb double-wall construction with 1-1/2" insulation, cant strips and cap flashing (roofing counter-flashing), with welded or sealed mechanical corner joints. Provide double-wall cover (lid) construction with 1" insulation core. Equip units with complete hardware set including hold-open devices, interior padlock hasps, and both interior and exterior latch handles. Provide gasketing. Fabricate units of following materials:
 - 1. Materials: Aluminum
 - 2. Size: As Indicated on Drawings.
- B. Sloping Roofs: Where slope or roof deck exceeds 1/4" per ft., fabricate hatch curbs with height tapered to match slope, to result in level installation of tops of units.
- C. Manufacturer: Subject to compliance with requirements, provide prefabricated roof hatch units by one of the following:
 - 1. Bilco Co.; New Haven CT. Basis of Design.
 - 2. Babcock-Davis Hatchways, Inc.
 - 3. Dur-Red Products; Cudahy, CA
 - 4. Hillsdale Industries, Inc.; Knoxville, TN
 - 5. Milcor, Inc.; Lima, OH

2.4 HATCH RAIL SYSTEM

- A. Furnish and install where indicated on plans hatch rail system. The hatch rail system shall be field assembled and installed (by others) per the manufacturer's instructions.
- B. Performance characteristics:
 - 1. High visibility safety yellow color shall be molded in.
 - 2. Hatch rail system shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
 - 3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a factor of safety of two.
 - 4. UV and corrosion resistant construction with a twenty-five year warranty.
 - 5. Self-closing gate shall be provided with hatch rail system.
- C. Posts and Rails: Shall be round pultruded reinforced fire retardant yellow fiberglass treated with a UV inhibitor.
- D. Hardware: Mounting brackets shall be 1/4" thick hot dip galvanized steel. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.
- E. Manufacturer: Subject to compliance with requirements, provide prefabricated roof hatch units by one of the following:
 - 1. Bilco Co.; New Haven CT. Basis of Design.
 - 2. Babcock-Davis Hatchways, Inc.
 - 3. Dur-Red Products; Cudahy, CA
 - 4. Hillsdale Industries, Inc.; Knoxville, TN
 - 5. Milcor, Inc.; Lima, OH

2.5 ROOF CURBS

A. Frames:

1. Material: ASTM A 653 G90 hot-dipped galvanized steel. Minimum 18 gauge or heavier gauge as engineered by manufacturer.
2. Corners: Mitered and welded. Bolted connections are not accepted.
3. Base Plates: Integral to frame and welded.
4. Insulation: RPC-1, 2 and 3 styles are insulated with 1-1/2 inch thick three-pound density fiberglass insulation.
5. Internal Reinforcement: RPC-1, 2 and 3 styles are reinforced with 1 inch by 1 inch angles on any side of curb 3 feet or more in length.

Wood Nailers: Factory installed, pressure treated.

B. Curb Height: Minimum 8 inches above finished roof or as specified.

C. Construct curbs to match roof slope with plumb and level top surface for mounting mechanical equipment, smoke vents, roof hatches and skylights, except where sloped top surface is shown on drawings.

D. Gasketing: 1/4 inch thick, 1 inch wide at roof top units and skylights.

E. Manufactured Roof Curb Styles with typical applications.

1. RPC-3 (non-canted style with insulation) installs either under or on top of metal decks.

F. 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. AES Industries, Inc.
2. Curbs Plus, Inc.
3. Custom Solution Roof and Metal Products.
4. Greenheck Fan Corporation.
5. LM Curbs.
6. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
7. Pate Company (The).
8. Roof Products, Inc.
9. Thybar Corporation.
10. Vent Products Co., Inc.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. General: Comply with manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive accessory units, and vapor barriers, roof insulation, roofing and flashing; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

1. FM I-90 wind uplift and 90 mph wind speed.

B. Isolation: Where metal surfaces of units are to be installed in contact with non-compatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation.

C. Flange Seals: Except as otherwise indicated, set flanges of accessory units in a thick bed of roofing cement, to form a seal.

D. Cap Flashing: Where cap flashing is required as component of accessory, install to provide adequate waterproof overlap with roofing or roof flashing (as counter-flashing). Seal with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.

E. Operational Units: Test operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.2 CLEANING AND PROTECTION:

- A. Clean exposed metal and plastic surfaces in accordance with manufacturer's instructions. Touch up damaged metal coatings.

END OF SECTION 07700

SECTION 07900 - JOINT SEALERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

- A. Extent of each form and type of joint sealer is indicated on drawings and schedules.

1.3 SYSTEM PERFORMANCES:

- A. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.4 SUBMITTALS:

- A. Product Data from manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application.
- B. Samples for Initial Selection Purposes: Manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- C. Certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.
- D. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project name, addresses, names of Architects and Owners, plus other information specified.
- E. Preconstruction field test reports indicating which products and joint preparation methods demonstrated acceptable adhesion to joint substrates.

1.5 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an Installer who has successfully completed within the last 5 years at least 3 joint sealer applications similar in type and size to that of this Project.
- B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.
- C. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
 - 1. Locate test joints where indicated or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - 3. Test Method: Test joint sealers by hand pull method described below:
 - a. Install joint sealants in 5-feet joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
 - b. Make knife cuts as follows: A horizontal cut from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2 inch cuts. Place a mark 1 inch from top of 2-inch piece.
 - c. Use fingers to grasp 2 inch piece of sealant just above 1 inch mark; pull firmly down at a 90 degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
 - 4. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.

5. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants which fail to adhere to joint substrates during testing.
 - D. Environmental Standards: Related sealant materials shall comply with provisions of the following:
 1. Environmental Protection Agency (EPA) requirements for less than 350 grams per liter of Volatile Organic Compounds (VOC).
 - E. Manufacturers Observation: Representative of manufacturer shall periodically make field observations, to verify that product and/or material is being installed according to project and manufacturer's specifications.
 1. Report: Submit copies of field observation report to Architect and Contractor, stating observations and any directives given to installer.
- 1.6 DELIVERY, STORAGE, AND HANDLING:
- A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
 - B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- 1.7 PROJECT CONDITIONS:
- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 deg F (4.4 deg C).
 2. When joint substrates are wet due to rain, frost, condensation, or other causes.
 - B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.
 - C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.
- 1.8 WARRANTY:
- A. Provide a two (2) year written warranty, signed by the installer, agreeing to repair/replace defective materials and workmanship that do not comply with performance and other requirements specified in this section within specified warranty period.
 1. Provide a complete review of the Warehouse floor area joint sealant installation after one year from Date of Substantial Completion. Replace all sealant demonstrating failure or excessive wear after this review at no additional cost. Replacement shall include any removal of old sealant, cleaning and preparation of the slab joints and installation of new joint sealant.

PART 2 – PRODUCTS

2.1 MATERIALS, GENERAL:

- A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

2.2 ELASTOMERIC JOINT SEALANTS:

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses.
- B. One-Part Nonacid-Curing Silicone Sealant: Type S, Grade NS, Class 25, and complying with the following requirements for Uses and additional joint movement capability:
 - 1. Uses NT, M, G, A, and, as applicable to joint substrates indicated, O.
 - 2. Additional capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage changes in joint width as measured at time of application and remain in compliance with other requirements of ASTM C 920 for Uses indicated:
 - a. 50 percent movement in both extension and compression for a total of 100 percent movement.
- C. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide; intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes. Install at all toilet fixture, urinal or wall hung lavatory locations.
- D. Nonsag Urethane Sealant for Use T/NT: Type S or M, Grade NS, Class 25, and complying with the following requirements for Uses:
 - 1. Uses T, NT, M, G, A, and, as applicable to joint substrates indicated, O.
- E. Nonsag Urethane Sealant for Use T: Type S or M, Grade NS, Class 25, and complying with the following requirements for Uses:
 - 1. Uses T and, as applicable to joint substrates indicated, O.
- F. Products: Subject to compliance with requirement, provide one of the following:
 - 1. One-Part Nonacid-Curing Silicone Sealant:
 - a. "Silpruf SCS 2000"; General Electric Co.
 - b. "Spectrum 2"; Tremco, Inc.
 - 2. Nonsag, Urethane Sealant for Use T and NT:
 - a. "Vulkem 116"; Tremco, Inc.
 - b. "Sikaflex – or 2C NS"; Sika Corp.
 - c. "NP 1"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.
 - d. "Dynatrol II"; Pecora
 - 3. Urethane Sealant for Use T:
 - a. "Chem-Calk 950"; Bostik.
 - b. "SL-1"; Sonneborn.
 - c. "Trem Flex S/L"; Tremco Inc
 - d. "Sikaflex - 2C SL"; Sika Corp.

2.3 LATEX JOINT SEALERS:

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C834, formulated to be paintable and recommended for exposed applications on interior and on protected exterior locations involving joint movement of not more than plus or minus 5 percent.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Acrylic-Emulsion Sealant:
 - a. "Chem-Calk 600"; Bostik Construction Products Div.
 - b. "AC-20"; Pecora Corp.
 - c. "Sonolac"; Sonneborn Building Products Div.; Rexnord Chemical Products, Inc.
 - d. "Tremco Acrylic Latex 834"; Tremco, Inc.

2.4 CONCRETE SLABS JOINT FILLER

- A. Two Component Semi-Rigid Epoxy: Two-component, 100% solids content epoxy joint filler. When cured, a semi-rigid (hard but slightly resilient) filler with a Shore hardness of A90-95.
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Two Component Semi-Rigid Epoxy:
 - a. "MM-80"; Metzger/McGuire
 - b. Euclid ???

2.5 JOINT SEALANT BACKING:

- 1. Either open-cell polyurethane foam or closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer, for cold-applied sealants only.

2.6 MISCELLANEOUS MATERIALS:

- A. General: Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonwaxing, nonextruding strips of flexible, nongassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
- D. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer- substrate tests and field tests.
- E. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
- F. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 – EXECUTION

3.1 EXAMINATION:

- A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers or joint fillers to comply with recommendations of joint sealer or joint filler manufacturer and the following requirements:
 - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellants; water; surface dirt; and frost.
 - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
 - B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
 - C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- 3.3 INSTALLATION OF JOINT SEALERS AND JOINT FILLERS:
- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.
 - C. Latex Sealant Installation Standard: Comply with requirements of ASTM C790 for use of latex sealants.
 - D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 1. Install backer rod of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant.
 - a. Do not leave gaps between ends of backer rod.
 - b. Do not stretch, twist, puncture, or tear backer rod.
 - c. Remove absorbent backer rod, which has become wet prior to sealant application and replace with dry material.
 2. Install bond breaker tape between sealants and backer rod, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
 - E. Installation of Two Component Semi-Rigid Epoxy Joint Filler:
 1. Surface Cleaning of Joints: Clean out joints immediately before installing joint filler.
 - a. Remove foreign material from joint substrates that could interfere with adhesion of joint filler.
 - b. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum
Bond with joint filler. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - c. Remove laitance and form-release agents from concrete.
 - d. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues could interfere with adhesion of joint sealants.
 - e. All surfaces to be filled shall be clean and dry.
 2. Joint Filler Installation: Comply with recommendations in ACI 302 for use of joint fillers as applicable to materials, application, and conditions indicated.
 - a. The joint must be clean and dry. All oil, dirt, debris, paint and any other material that may be a bond breaker must be removed from the joint surfaces.
 - b. All concrete floor lab sealant and polishing processes must be completed prior to installation of filler.
 - c. For proper load transfer, joints must be filled full depth, but in no case should the joint filler be any less than 1" deep in the joint.
 - d. Mixing: Joint filler is a two part product requiring machine mixing and placing. Premix Part B separately before using. Follow pump manufacturer's equipment instructions.

- e. Placement: Joint filler shall be filled full depth. NO BACKER ROD IS ALLOWED. Joint should be overfilled and shaved even with the surrounding joint edge giving the floor joints a flat, smooth appearance. Shaving of excess joint filler can be approximately 30 minutes after placement, and up to 24 hours later, depending on jobsite conditions such as concrete and ambient temperatures.
 - F. Sealant and Filler Application Schedule: Use sealant or filler types indicated for the following applications, whether they are indicated on drawings or not. Where two types of sealants are indicated, either type may be used.
 - 1. Joints in all exterior and interior similar and dissimilar materials, in non-traffic areas:
 - a. Use Nonsag Urethane Sealant.
 - b. Use One-Part Non-Acid-Curing Silicone Sealant.
 - 2. Joints in exterior and interior sloped and vertical surfaces in traffic areas:
 - a. Use Nonsag Urethane Sealant-T.
 - b. Use One-Part Non-Acid-Curing Silicone Sealant.
 - 3. Joints in all exterior and interior horizontal surfaces in traffic areas:
 - a. Use Multi-Part Pourable Urethane Sealant-T.
 - b. Use One-Part Non-Acid-Curing Silicone Sealant.
 - 4. Joints at copings and counterflashing between coping and counterflashing and vertical surface:
 - a. Use Nonsag Urethane Sealant.
 - b. Use One-Part Non-Acid-Curing Silicone Sealant.
 - 5. Joints between precast concrete panels:
 - a. Use Nonsag Urethane Sealant.
 - 6. Joints in all exposed concrete interior horizontal slab-on-grade surfaces in traffic areas:
 - a. Use Two Component Semi-Rigid Epoxy Joint Filler. The joint filler application must result in the surface being flush with the concrete shoulders. The filler must not be concave, thereby exposing joint edges to wheeled traffic.
 - G. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.
- 3.4 CLEANING:
- A. Clean off excess sealants, filler, or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.
- 3.5 PROTECTION:
- A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

END OF SECTION 07900

SECTION 08111 - STEEL DOOR FRAMES

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 DESCRIPTION OF WORK:

- A. Extent of standard steel door frames is indicated and scheduled on drawings.

1.3 QUALITY ASSURANCE:

- A. Provide door frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.
- B. Fire-Rated Assemblies: Where fire-rated assemblies are indicated or required, provide fire-rated door frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements. Submit wind load testing data as required by State Building Code and Local Building Official.
- B. Shop Drawings: Submit for fabrication and installation of steel door frames. Include details of each frame type, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of welded joints and connections. Show anchorage and accessory items.
 - 1. Provide schedule of door frames using same reference numbers for details and openings as those on contract drawings.
 - 2. Indicate coordinate of glazing frames and stops with glass and glazing requirements.
 - 3. Detail anchorage requirements for wind load compliance.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory-finished doors.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

- 1.6 Store door frames at building site under cover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide steel door frames by one of the following:
 - 1. Ceco Door Products
 - 2. Curries Co.
 - 3. Steelcraft Manufacturing Co.

2.2 MATERIALS:

- A. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- B. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.
- C. Supports and Anchors: Fabricate of hot less than 18-gage galvanized sheet steel.
- D. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.
- E. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.
- F. Shop Applied Paint:
 - 1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.3 FABRICATION, GENERAL:

- A. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from cold-rolled steel.
- B. Fabricate exterior door frames from galvanized sheet steel.
- C. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.
- D. Finish Hardware Preparation: Prepare door frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 series specifications for door and frame preparation for hardware.
- E. Reinforce door frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
- F. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.
- G. Shop Painting:
 - 1. Clean, treat, and paint exposed surfaces of steel door frame units, including galvanized surfaces.
 - 2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.
 - 3. Apply asphaltic emulsion coating to frame inside surfaces to be grouted.

2.4 STANDARD STEEL FRAMES:

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of cold-rolled furniture steel with equal size rabbet and minimum 5/8" stop.
 - 1. Interior Frames: Fabricate frames of minimum 16 gage.
 - 2. Exterior Frames: Fabricate frames of minimum 14 gage.
 - 3. Fabricate frames with mitered and welded corners.
 - 4. Fabricate gypsum wallboard frames with mitered and welded corners.
- B. Door Silencers: Except on weather stripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.
- C. Plaster Guards: Provide 26-gage steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- D. Coordinator: For doors which have been tested with surface mounted astragal, provide GJ-COR door coordinator.

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames", unless otherwise indicated.
 - 1. General: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 2. In masonry construction, locate minimum of 3 wall anchors per jamb at hinge and strike levels or as mandated by Building Code wind load compliance.
 - 3. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
 - 4. Install fire-rated frames in accordance with NFPA Std. No. 80.
 - 5. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed steel studs partitions, attach wall anchors to studs with tapping screws.
 - 6. Glazed frames; provide standard glazing bead, attached with self-drilling flat head screws.
 - 7. Where frames are installed with exposed anchors provide polyester resin with catalyst hardener filler (bondo) to conceal anchors.
 - 8. All frames set in masonry or concrete shall be grouted solid.

END OF SECTION 08111

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SECTION 08211 - FLUSH WOOD DOORS

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.
- B. See division 8, Door Hardware for lock cylinder and keying.

1.2 DESCRIPTION OF WORK:

- A. Extent and location of each type of flush wood door is indicated on drawings and in schedules.
- B. Option: At contractor's option, doors may be factory-prefit and premachined in lieu of job-fit
- C. Related Sections:
 - 1. Division 08 Doors and Windows
 - 2. Division 06 Section Rough Carpentry
- D. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ANSI A208.1 – Wood Particleboard.
 - 3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
 - 4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
 - 5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
 - 6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
 - 7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors

1.3 SUBMITTALS:

- A. Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
- B. Information to be uploaded to Site|Folio (www.sitefolio.net)
- C. Door schedule with same reference designations as indicated on drawings and door schedule.
- D. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.
 - 1. For factory-premachined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.

1.4 QUALITY ASSURANCE:

- A. Quality Standards: Complying with the following standards:
 - 1. WDMA Quality Standard: I.S.I. "Industry Standard for Wood Flush Doors", or The Window and Door Manufacturers Association (WDMA).
 - 2. AWI Quality Standards: "Architectural Woodwork Quality Standards", including Section 1300 "Architectural Flush Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of WDMA quality standard.
- B. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.
- C. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152 and which are labeled and listed for ratings indicated by UL, Warnock Hersey or other testing and inspection agency acceptable to authorities having jurisdiction.

- D. Manufacturers: Obtain doors from a single manufacturer.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

- A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standards and recommendations of WDMA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.
- B. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable, or concealed markings.

1.6 PROJECT CONDITIONS:

- A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:
 - 1. Referenced AWI quality standard including Section 100-S-3 "Moisture content".

1.7 WARRANTY:

- A. General: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
- B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by Manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors which have warped (bow, cup, or twist) or that show telegraphing of core construction, in face veneers, or do not conform to tolerance limitations of referenced quality standards.
 - 1. Solid Core Interior Doors:
 - a. Life of installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide doors of one of the following:
 - 1. Solid Core Doors with Wood Veneer Faces:
 - a. Chappell
 - b. Mohawk
 - c. Weyerhaeuser Company
 - d. Algoma Hardwoods: Architectural Series.
 - e. Eggers Industries: Premium.
 - f. Graham: GPD.
 - g. Marshfield: Signature.
 - h. VT Industries: Artistry

2.2 INTERIOR FLUSH WOOD DOORS:

- A. Solid Core Doors for Transparent Finish: Comply with the following requirements:
 - 1. Faces: Birch, plain sliced.
 - 2. AWI Grade: Premium.
 - 3. Construction: PC-5 (Particleboard core, 5-ply) Glued Core.
- B. Fire-Rated Solid Core Doors: Comply with the following requirements:
 - 1. Faces and AWI Grade: Provide faces and grade to match nonrated doors in same area of building, unless otherwise indicated.
 - a. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.

- b. Edge Construction: Provide manufacturer's standard laminated edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber. Edges shall match wood species of face veneer.

2.3 LIGHT FRAMES:

- A. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard frame formed of 18-gage cold-rolled steel, factory-primed, and approved for use in door of fire-rating indicated.
- B. Wood Beads for Light Openings in Non-Fire Doors: Manufacturer's standard wood-veneer beads matching veneer species of door faces.

2.4 FABRICATION:

- A. Fabricate flush wood doors to comply with following requirements:
 - 1. In sizes indicated for job-site fitting.
 - 2. Factory-prefit and premachine doors to fit frame opening sizes indicated with the following uniform clearances and bevels.
 - a. Comply with tolerance requirements of AWI for prefitting. Comply with final hardware schedules and door frame shop drawings and with hardware templates.
 - b. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with factory premachining.
- B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of doors required.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.

2.5 FACTORY FINISHINGS:

- A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
 - 1. Finish perimeter edge of doors with same finish system as used on door face.
- B. Transparent Finish for Open Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen.
 - 1. Grade: Premium.
 - 2. Finish: AWI Finish System #3 alkyd-urea conversion varnish.
 - 3. Staining: To match approved sample for color.
 - 4. Effect: Closed grain (filled finish).
 - 5. Sheen: Satin-medium rubbed effect.

PART 3 – EXECUTION

3.1 EXAMINATION:

- A. Examine installed door frames prior to hanging door.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
 - 2. Reject doors with defects.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. Hardware: For installation see Division-8, "Finish Hardware" section of these specifications.
- B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.

- C. Job Fit Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
1. Fitting Clearances for Non-Rated Doors: Provide 1/8" at jambs and heads; 1/16" per leaf at meeting stiles for pairs of doors; and 1/8" from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4" clearance from bottom of door to top of threshold.
 2. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80.
 3. Bevel non-rated doors 1/8" in 2" at lock and hinge edges.
 4. Bevel fire-rated doors 1/8" in 2" in lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Prefit Doors: Fit to frames for uniform clearance at each edge.

3.3 ADJUSTING AND PROTECTION:

- A. Operation: Rehang or replace doors which do not swing or operate freely.

END OF SECTION 08211

SECTION 08711 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 06 Section "Rough Carpentry".
 - 2. Division 06 Section "Finish Carpentry".
 - 3. Division 08 Section "Operations and Maintenance".
 - 4. Division 08 Section "Door Schedule".
 - 5. Division 08 Section "Door Hardware Schedule".
 - 6. Division 08 Section "Hollow Metal Doors and Frames".
 - 7. Division 08 Section "Interior Aluminum Doors and Frames".
 - 8. Division 08 Section "Flush Wood Doors".
 - 9. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 10. Division 08 Section "Automatic Entrances".
 - 11. Division 08 Section "Automatic Door Operators".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 80 - Fire Doors and Windows.
 - 4. NFPA 101 - Life Safety Code.
 - 5. NFPA 105 - Installation of Smoke Door Assemblies.
 - 6. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 2. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - 3. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - 2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: Final Cores & Keys are to be provided by Lowe's Loss Prevention Department. Schedule to include details for Owner's final keying instructions for the locks.

- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.
- G. Submittals and information are to be uploaded to Site|Folio (www.sitefolio.net)

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
 - 1. Scheduling Responsibility: Preparation of door hardware.
- D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
 - 1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
 - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
 - 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.

- 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
- 3. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Thresholds: Not more than 1/2 inch high.
- 4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
 - a. Test Pressure: Positive pressure labeling.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- 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.

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. 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. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within warranty period.
 - 1. Seven years for heavy duty cylindrical (bored) locks and latches.
 - 2. Twenty five years for manual surface door closers.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
 - 1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
 - 1) Out-swinging exterior doors.
 - 2) Out-swinging access controlled doors.
 - 3) Out-swinging lockable doors.
 5. Acceptable Manufacturers:
 - a. McKinney Products (MK).
 - b. Hager Companies (HA).
 - c. Stanley Hardware (ST).

2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
1. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).
 - b. Ives (IV).
 - c. Hager Companies (HA).

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
 - 1. Acceptable Manufacturers:
 - a. Stanley Best (BE).
 - b. No Substitution – Facility Standard.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Match Facility Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:
 - 1. Master Key System: Cylinders are operated by a change key and a master key.
- E. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed by construction project manager

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified cylindrical (bored) locksets furnished in the functions as specified in the Hardware Sets. Lock chassis fabricated of heavy gauge steel, zinc dichromate plated, with through-bolted application. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt. Locks are to be non-handed and fully field reversible.
 - 1. Acceptable Manufacturers:
 - a. Sargent Manufacturing (SA) – 10 Line.
 - b. Stanley Best (BE) – 9K Series.
 - c. Yale Locks and Hardware (YA) 5400LN Series.
- B. Lock Trim Design: As specified in Hardware Sets.

2.6 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
 4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - a. Fire Exit Removable Mullions: Provide keyed removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions to be used only with exit devices for which they have been tested.
 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is not acceptable except in any case where the door light extends behind the device as in a full glass configuration.
 5. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. Provided free-wheeling type trim where indicated.
 - b. Where function of exit device requires a cylinder, provide an interchangeable core type keyed cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
 - a. Detex Mfg (DE)
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Adams Rite Manufacturing (AD) – 8700 Series

2.8 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
 - b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
 - c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
 - d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.
- B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
1. Acceptable Manufacturers:
 - a. Norton Door Controls (NO) - 8500 Series.
 - b. Sargent Manufacturing (SA) - 1431 Series.
 - c. Stanley Hardware (ST) - CLD-4551 Series.

2.9 ARCHITECTURAL TRIM

- A. Door Protective Trim
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
 3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following:
 4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
 5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.

6. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).
 - b. Ives (IV).
 - c. Hager Companies (HA).

2.10 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Acceptable Manufacturers:
 - a. Rockwood Manufacturing (RO).
 - b. Ives (IV).
 - c. Hager Companies (HA).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Acceptable Manufacturers:
 - a. Rixson Door Controls (RF).
 - b. Rockwood Manufacturing (RO).
 - c. Sargent Manufacturing (SA).

2.11 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
 - 1. Pemko Manufacturing (PE).
 - 2. Hager Companies (HA).
 - 3. Zero International (ZE).

2.12 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.13 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DOOR HARDWARE SCHEDULE

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:
 - 1. MK - McKinney
 - 2. RO - Rockwood
 - 3. SA - Sargent
 - 4. DE - Detex Corporation
 - 5. BE - Stanley Security Solutions Inc (BE)
 - 6. RF - Rixson
 - 7. NO - Norton
 - 8. PE - Pemko

Hardware Schedule

Set: 4.0

Doors: 102A, 103A

Description: WOMENS TOILET, MEN'S TOILET

3 Hinge	MPB79 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	28 10U15 LL	US26D	SA
1 Surface Closer	8501 DA TBGN	689	NO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

END OF SECTION 08711

SECTION 09260 - GYPSUM WALLBOARD ASSEMBLIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provision of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of each type of gypsum drywall construction required is indicated on drawings.

1.3 QUALITY ASSURANCE:

- A. Fire-Resistance Ratings: Where gypsum wallboard systems with fire-resistance rating are indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to authorities having jurisdiction.
 - 1. Provide fire-resistance treated assemblies identical to GA File No. in GA "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction.
- B. Application and Finishing of Gypsum Board: Gypsum Association Publication GA-216- 2000.
- C. Single-Source Responsibility: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.
- D. Environmental Standards: Related materials shall comply with provisions of the following:
 - 1. Environmental Protection Agency (EPA) National Volatile Organic Compound (VOC) Emission Standards for Architectural Coatings, unless more stringent standards are required by authorities having jurisdiction.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's product specifications and installation instructions for each gypsum wallboard component, including other data as may be required to show compliance with these specifications.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.6 PROJECT CONDITIONS:

- A. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.
- B. Cold Weather Protection: When ambient outdoor temperatures are below 55 F (13 C) maintain continuous, uniform, comfortable building working temperatures of not less than 55 F (13 C) for a minimum period of 48 hours prior to, during and following application of gypsum board and joint treatment materials or bonding of adhesives.
- C. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Metal Support Materials:
 - a. Allied Structural Industries.
 - b. Clark Steel Framing Systems.
 - c. Consolidated Systems, Inc.
 - d. Dale Industries, Inc.
 - e. Dietrich
 - f. Gold Bond Building Products Div.; National Gypsum Co.
 - g. Marino Industries
 - h. Unimast, Inc.
2. Direct Suspension Systems:
 - a. Chicago Metallic Corp.
 - b. National Rolling Mills Co.
3. Gypsum Board and Related Products:
 - a. Centex American Gypsum Co.
 - b. Georgia-Pacific Corp.
 - c. Gold Bond Building Products Div.; National Gypsum Co.
 - d. United States Gypsum Co.
4. Cementitious Backer Board:
 - a. Modulars, Inc.
 - b. USG Industries, Inc.
 - c. Laticrete International, Inc.
5. Aluminum Trim:
 - a. Fry Reglet Corp.
 - b. Gordon Inc.
 - c. Milgo/Bufkin
 - d. Pittcon Industries
6. Sound Attenuation Insulation:
 - a. CertainTeed Corp.
 - b. Knauf Fiber Glass Gmbh
 - c. Manville Corp.
 - d. Owens-Corning Fiberglass Corp.

2.2 METAL SUPPORT MATERIALS:

A. Ceiling Support Materials and Systems:

1. General: Size ceiling support components to comply with ASTM C 754 unless otherwise indicated on plans.
2. Main Runners: Steel channels with rust inhibitive paint finish, hot or cold-rolled.
3. Hanger Wire: ASTM A 641, soft, Class 1 galvanized.
4. Hanger Anchorage Devices: Screws, clips, bolts, inserts or other devices applicable to the indicated method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3x calculated load supported except size direct pull-out concrete inserts for 5x calculated loads.
5. Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, hat-shaped.
6. Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, C-shaped studs.
7. Furring Anchorages: 16-gage galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws as recommended by furring manufacturer and complying with C 74.

8. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - a. Direct Suspension Systems: Manufacturer's standard zinc-coated or painted steel system of furring runners, furring tees, and accessories designed for concealed support of gypsum drywall ceiling; of proper type for use intended.
 - b. Products: Subject to compliance with requirements, provide one of the following:
 - i Armstrong World Industries, Inc.; Furring Systems Drywall.
 - ii Chicago Metallic Corporation; Drywall Furring 660 Heavy Duty System.
 - iii USG Interiors, Inc.; Drywall Suspension System.

B. Wall/Partition Support Materials:

1. Studs: ASTM C 645; thickness of base metal as indicated.
 - a. Depth of Section: as indicated.
 - b. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

2.3 GYPSUM BOARD:

- A. Gypsum Wallboard: ASTM C 36, of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.
 1. Type: Regular, unless otherwise indicated.
 2. Type: Type X for fire-resistant rated assemblies and where indicated.
 3. Edges: Tapered and featured (rounded or beveled) for prefilling.
 4. Thickness: As indicated, or if not otherwise indicated, as required to comply with ASTM C 840 for application system and support spacing indicated.
- B. Gypsum Backing board for Multi-Layer Applications: ASTM C 442 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 36, of type, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end joints.
 1. Type: Regular, unless otherwise indicated.
 2. Type: Type X for fire-resistance rated assemblies and where indicated.
 3. Edges: Square, non-tapered; or V-tongue and groove.
 4. Thickness: As indicated, or if not otherwise indicated, as required to comply with ASTM C 840 for application system and support spacing indicated.
- C. Cementitious Backer Board: Panels composed of a concrete core with glass fiber mesh reinforcing on both faces covered with portland cement; average weight 3.4 lbs. Per sq. ft.; 5/8" thickness. Provide one of the following:
 1. "Wonder Board" Modulars, Inc.
 2. "Durock Tile Backer Board"; DuraBond
 3. "Latapanel MFR-100" Laticrete
- D. Water-Resistant Backing Board: ASTM C 630, of types, edge configuration and thickness indicated below; in maximum lengths available to minimize end-to-end butt joints.
 1. Type: Regular, unless otherwise indicated.
 2. Edges: Tapered and featured (rounded or beveled) for prefilling.
 3. Thickness: As indicated, or if not otherwise indicated, as required to comply with ASTM C 840 for application system and support spacing indicated.

2.4 TRIM ACCESSORIES:

- A. General: Provide manufacturer's standard trim accessories of types indicated for gypsum wallboard work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads.
- B. Aluminum Trim: Provide manufacturer's standard or custom trim of type indicated, of extruded 6063 T5 aluminum, with prepunched tapered fin and beaded for concealment of fin in joint compound.
 - 1. Standard Finish: Where aluminum trim is indicated to be field finished with paint or wallcovering, provide manufacturer's standard finish.
 - 2. Prefinished: Where aluminum trim is indicated to be prefinished, provide color indicated or if not indicated, as selected by Architect.
 - a. Samples: Provide samples of prefinished aluminum trim for approval of Architect.

2.5 JOINT TREATMENT MATERIALS:

- A. General: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
- B. Joint Tape: paper reinforcing tape.
- C. Joint Compound: Ready-mixed vinyl-type for interior use.
 - 1. Grade: 2 separate grades; one specifically for bedding tapes and filling depressions, and one for topping and sanding.

2.6 MISCELLANEOUS MATERIALS:

- A. General: Provide auxiliary materials for gypsum wallboard work of the type and grade recommended by the manufacturer of the gypsum board.
- B. Laminating Adhesive: Special adhesive or joint compound specifically recommended for laminating gypsum boards.
- C. Gypsum Board Screws: Comply with ASTM C 646.
- D. Concealed Acoustical Sealant: Nondrying, nonhardening, non-skinning, nonstaining, nonbleeding, gunnable sealant for concealed applications per ASTM C 919.
- E. Exposed Acoustical Sealant: Nonoxidizing, skinnable, paintable, gunnable sealant for exposed applications per ASTM C 919.
- F. Unfaced Mineral Fiber Sound Attenuation Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C665 for Type I (blankets without membrane facing); and as follows:
 - 1. Mineral Fiber Type: Fibers manufactured from glass.
 - 2. Combustion Characteristics: Passes ASTM E 136 test.
 - 3. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.
- G. Insulation Supports: Provide insulation supports of the type required to hold insulation into its intended location for the life of the installation.
 - 1. 13 Gage carbon steel wire with chisel cut ends.
 - 2. Other products as required to suit particular installation requirements.

PART 3 – EXECUTION

3.1 PREPARATION FOR METAL SUPPORT SYSTEMS:

- A. Ceiling Anchorages: Coordinate work with structural ceiling work to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling hangers.
 - 1. Furnish inserts, steel deck hanger clips and similar devices to other trades for installation well in advance of time needed for coordination with other work.

3.2 INSTALLATION OF METAL SUPPORT SYSTEMS:

A. General:

- 1. Metal Support Installation Standard: Comply with ASTM C 754.
- 2. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.
- 3. Exterior Soffits provide additional bracing to resist wind uplift.
- 4. At Contractors Option, directed-hung metal ceiling support system may be used in lieu of indirect hung metal ceiling support system.

B. Ceiling Support Suspension Systems:

- 1. Secure hangers to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips or other anchorage devices or fasteners as indicated. space 4'-0" maximum o.c. along runners.
 - a. Do not attach or suspend suspension system from ductwork, pipes or conduit.
- 2. Space main runners per system supplier design recommendations for type of system provided and installation conditions.
- 3. Level main runners to a tolerance of 1/4" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.
- 4. Wire-tie or clip furring members to main runners and to other structural supports as indicated.
- 5. Direct-hung Metal Support System: Attach perimeter wall track or angle wherever support system meets vertical surfaces. Mechanically join support members to each other and butt-cut to fit into wall track.
- 6. Space furring as indicated.
- 7. Install auxiliary framing at termination of gypsum wallboard work, and at openings for light fixtures and similar work, as required for support of both the gypsum wallboard construction and other work indicated for support thereon.

C. Wall/Partition Support Systems:

- 1. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars toilet accessories, furnishings, and similar work to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.
- 2. Isolate stud system from live load deflection and transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
- 3. Install runner tracks at floors, ceilings and structural walls and columns where gypsum wallboard stud system abuts other work, except as otherwise indicated.
- 4. Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural support and substrate above the ceiling.
- 5. Terminate partition stud system at ceilings, except where indicated to be extended to structural support or substrate above.
- 6. Space studs as indicated.

7. Frame door openings with 20 ga. studs complying with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co. Attach vertical studs at jamb with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs.
8. Frame openings other than door openings to comply with details indicated or if not indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

3.3 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS:

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA 216.
 1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09911 "Painting."
 2. Level 5: At panel surfaces which contains murals.
 - a. Primer and its application to surfaces are specified in Section 09911 "Painting."
- B. Install sound attenuation blankets as indicated, prior to gypsum board unless readily installed after board has been installed.
- C. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.
- D. Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".
- E. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
- F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
- G. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
- H. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
 1. Form control and expansion joints in gypsum board surfaces to comply with requirements indicated and those of referenced application standard and recommendations of manufacturer. Prepare joints to receive trim accessories. Locate where indicated, or if not indicated, as required by referenced standard and coordinated with Architect.
- I. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are braced internally.
 1. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and may be limited to not less than 75% of full coverage.
- J. Isolate perimeter of nonload-bearing gypsum wallboard partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant.
- K. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

- L. Radius Work: Where radius is indicated, terminate gypsum wallboard system at tangent point and use veneer plaster system of same thickness. Refer to Division-9 Section on Veneer Plaster.

3.4 INSTALLATION OF SOUND ATTENUATION INSULATION - CEILINGS:

- A. Ceiling Plenum: Where indicated, apply sound attenuation insulation in ceiling plenum from top of ceiling to bottom of structure above to provide sound transmission barrier. Cut, fit and tape around all penetrations. Attach in place using mechanical anchorage to provide permanent placement and support of insulation.
- B. Suspended Ceiling: Where indicated, set sound attenuation insulation on top of ceiling panels of suspended ceiling, extend insulation 4'-0" from each side of partition terminated at ceiling unless noted otherwise.

3.5 METHODS OF GYPSUM WALLBOARD APPLICATION:

- A. Single-Layer Application: Install gypsum wallboard.
 - 1. On ceilings apply gypsum board prior to wall/partition board application to the greatest extent possible.
 - 2. On partitions/walls apply gypsum board vertically (parallel), unless otherwise indicated, and provide sheet lengths which will minimize end joints.
 - 3. On partitions/walls 8'-1" or less in height apply gypsum board horizontally (perpendicular); use maximum length sheets possible to minimize end joints.
- B. Wall Tile Base: Where gypsum wallboard is base for thin-set ceramic tile and similar rigid applied wall finishes, install gypsum backing board.
 - 1. At showers; tubs and similar "wet areas", glass mesh mortar units shall be installed. Do not use water-resistant backing board. Refer to Division-9 section on Ceramic Tile.
- C. Double-Layer Application: Install gypsum backing board for base layer and exposed gypsum board for face layer.
 - 1. On ceilings apply base layer prior to base layer application on walls/partitions; apply face layers in same sequence. Offset joints between layers at least 10". Apply base layers at right angles to supports unless otherwise indicated.
 - 2. On partitions/walls apply base layer and face layers vertically (parallel) with joints of base layer over supports and face layer joints offset at least 10" with base layer joints.
- D. Single-Layer Fastening Methods: Apply gypsum boards to supports as follows:
 - 1. Fasten with screws.
- E. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:
 - 1. Fasten both base layers and face layers separately to supports with screws for fire resistance rated assemblies.
 - 2. Fasten base layer with screws and face layer with adhesive and supplementary fasteners for non rated assemblies.

3.6 INSTALLATION OF GYPSUM WALLBOARD TRIM ACCESSORIES:

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendation.
- B. Install metal corner beads at external corners of drywall work.
- C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).
- D. Install metal control joint (beaded-type) where indicated, or if not indicated, in accordance with manufacturers recommendations and not less than 30' on center.

E. Aluminum Trim: Install aluminum trim using standard gypsum wallboard finishing techniques according to manufacturer's literature.

1. End Caps: Where gypsum wallboard partition terminates and gypsum wallboard column wrap meets exterior glass curtain wall, etc., provide either standard or custom Gordon Inc. "Series 910" end caps as indicated.

3.7 FINISHING OF GYPSUM WALLBOARD:

- A. General: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.
1. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.
 2. Apply joint compound in 3 coats (not including prefill of openings in base), and sand between last 2 coats and after last coat.
- B. Regular Gypsum Board Base for Ceramic Tile: In areas to be tiled using organic adhesive, tape joints and apply 4" wide coat of joint compound.
- C. Partial Finishing: Omit third coat (if specified) and sanding on concealed gypsum wallboard work which is indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

3.8 PROTECTION OF WORK:

- A. Provide final protection and maintain conditions, in a manner suitable to installer, which ensures gypsum drywall work being without damage or deterioration at time of substantial completion.

END OF SECTION 09260

SECTION 09261 - GYPSUM WALLBOARD DECORATIVE TRIM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provision of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Aluminum Decorative trim applied to gypsum wallboard.

1.3 QUALITY ASSURANCE:

- A. Manufacturer: Firm with manufacturing and delivery capacity required for the project, shall have successfully completed at least ten projects within the past five years, utilizing systems, materials and techniques as herein specified.
- B. Fabricator must own and operate its own manufacturing facilities for all metal components. Systems consisting of components from a variety of manufacturers will not be considered or accepted.
- C. Manufacturer/Fabricator must own and operate its own painting and finishing facility to assure single source responsibility and quality control.

1.4 SUBMITTALS:

- A. Manufacturer's Literature and Data:
 - 1. Product Data: Submit manufacturer's technical data and brochures for each type of specified component required, including detail drawings and installation instructions.
- B. Shop Drawings:
 - 1. Shop drawings shall show dimensions, sizes, thickness, alloys, tempers, finishes, joining, attachments and relationship of adjoining work.
- C. Samples:
 - 1. Samples shall include three, 6" samples of each type of final form and finish as specified and accessories.
- D. Certification:
 - 1. Submit certification from manufacturer of accessory attesting that products comply with specified requirements including finish as specified.
- E. Qualification Data:
 - 1. Firms specified in "Quality Assurance" Article must demonstrate their capabilities and experience by including lists of completed projects with project names and addresses, names and addresses of architects and owners and other information specified.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. All materials shall be protected during fabrication, shipment, site storage and erection to prevent damage from other trades. Store accessories inside a well-ventilated area, away from uncured concrete and masonry, and protected from the weather, moisture, soiling, abrasion, extreme temperatures and humidity.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS:**

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Metal Decorative Trim:

- a. Gordon Interior Specialties Division: Final Forms I.
- b. Kawneer North America.
- c. EFCO.
- d. Pittco Architectural Metals Inc.

2.2 MATERIALS:

A. Aluminum extrusions: 6063 per ASTM B 221 and ASTM B 221 Metric.

B. Accessories: Manufacturer's standard inserts, alignment devices, and end closures.

C. General: Provide metals free from surface blemishes where exposed to view in finished unit. Surfaces that exhibit pitting, seam marks, roller marks, stains, and discolorations, or other imperfections on finished units are not acceptable. All metal shall be of the highest-grade commercial type.

2.3 FABRICATION:

A. Provide extruded aluminum trims of design, profile and function as indicated. Select trims to suit reveal width and depth in 10' - 0" lengths to reduce the number of end joints.

B. Provide pre-welded and soldered, mitered intersections where reveal changes direction or abuts other trim.

C. Provide pre-slotted reveals to facilitate ventilation as required with a minimum of 0.150 square inches per slot. Partial slots at joints are not acceptable when vented trims are abutted end to end.

D. All attachment flanges are perforated to allow attachment to the structure of a minimum of 8" O.C.

2.4 FINISHES

A. All aluminum material shall be factory color anodized for interior applications.

PART 3 - EXECUTION**3.1 INSPECTION:**

A. Examination of Surfaces: Installer must examine conditions under which work is to be performed and must notify contractor in writing of unsatisfactory conditions.

B. Verify that field measurements are as shown on shop drawings.

3.2 INSTALLATION OF DECORATIVE TRIM:

A. General: Comply with manufacturer's printed instructions, with governing regulations for Seismic Codes, and with the Ceiling & Interior Systems Construction Association standards applicable to work.

B. Space Enclosure: Do not install any work until space is enclosed and weatherproofed, wet-work in space is completed and nominally dry, work above ceilings is complete, and temperature and humidity shall be continuously maintained at values near those of final occupancy.

3.3 CLEANING:

A. Clean exposed surfaces as recommended by manufacturer.

3.4 PROTECTION:

A. Procedures: Advise the contractor of procedures required to protect the finished work from damage during the remainder of the construction period.

B. Damage to finished work: Finished units shall be without damage. Damage shall be repaired by the contractor at the expense of the party damaging the material, in accordance with the contract requirements

3.5 GENERAL RESPONSIBILITY:

- A. Variation from specification: Any variation from this specification resulting in additional cost to any other contractor or subcontractor on this project shall be the sole financial responsibility of the contractor for the work of this section.

END OF SECTION 09261

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SECTION 09510 - ACOUSTICAL PANELS (IF INDICATED ON DRAWINGS)

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes: Cementitious wood fiber acoustical cloud ceiling system, encapsulated fiberglass, suspension grid & acoustical treatment.
- B. Ceiling suspension grid system must be at minimum intermediate-duty with 1½ inch (38 mm) high square bulb main runners and cross tees.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E1264 Standard Classification for Acoustical Ceiling Products.
- B. Ceilings and Interior Systems Construction Association (CISCA):
 - 1. CISCA Code of Practices.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Provide acoustical ceiling assembly designed and tested to provide surface burning characteristics (ASTM E84) as follows:
 - a. Flamespread: 0.
 - b. Smoke Developed: 0.

1.4 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.
- B. Product Data: Submit manufacturer's product data and installation instructions.
- C. Samples: Submit selection and verification samples: 6 inch × 6 inch (152 × 152 mm) sample for each wood fiber ceiling unit required, showing full range of exposed texture to be expected in completed work.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity.

1.6 DELIVERY, STORAGE & HANDLING

- A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
 - 1. Prevent soiling, physical damage or wetting.
 - 2. Store cartons open at each end to stabilize moisture content and temperature.

1.7 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install ceiling panels until building is closed in and HVAC system is operational.
 - 2. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
 - 3. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
 - a. Relative Humidity: 65 - 75%.

- b. Uniform Temperature: 55 - 70 degrees F (13 - 21 degrees C).

1.8 MAINTENANCE

- A. Extra Materials: Provide a recommended percentage of 5% additional material for use by owner in building maintenance and repair.
- B. Provide new unopened cartons of extra materials, packaged with protective covering for storage and identified with appropriate labels.

PART 2 – PRODUCTS

2.1 ACOUSTICAL CEILING SYSTEM

- A. Manufacturer: Tectum Inc.
 - 1. Contact: 105 South Sixth Street, Newark, OH 43055; Telephone: (888) 977-9691, (740) 345-9691; Fax: (800) 832-8869; E-mail: info@tectum.com; website: www.tectum.com.
 - 2. Tectum Square Cloud Panels:
 - a. Material: Aspen wood fibers bonded with inorganic hydraulic cement.
 - b. Thickness: 1½ inches
 - c. Length: As indicated on drawings.
 - d. Width: 23 ¾ inches and 47 ¾ inches.
 - e. Color: Natural Color for field painting.
 - f. Mounting Style: “E-400”. Heavy Duty Main Runners, Hanger wire and attachment devices.
 - g. Perimeter 1x4 wood frame screw attached as shown on drawings.
 - h. Gray PVC encapsulated fiberglass 2” thick - NRC .95 by CMA, Inc. or G&S Acoustics.

2.2 CEILING PRODUCTS

- A. Acoustical Baffles: Wrapped panels, with core of 3lb pcf fiberglass, seamless finish material wrapped and bonded on centerline of panels.
- B. Core Thickness: 2 inches (51 mm).
- C. Size: As indicated.
- D. Finish Material: Manufacturer's standard polyvinyl sheet (PVC)
- E. Edges: Square.
- F. Corners: Square.
- G. Color: As scheduled for various locations.
- H. Mounting: Multiple mounting points for wire or chain suspension:
- I. Provide grommets in flap at top.

2.3 ACCESSORIES

- A. Mounting: Hanger wire tied off and cut tail neatly.

PART 3 – EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

- A. Comply with the instructions and recommendations of the ceiling system manufacturer.
- B. Install materials in accordance with governing regulations, fire resistance rating requirements and industry standards applicable to work.
 - 1. Comply with CISCA Code of Practices.

3.2 EXAMINATION

A. Site Verification of Conditions:

1. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness that would affect quality and execution of work.
2. Do not proceed with installation of ceiling system until unacceptable conditions are corrected.

3.3 CLEANING

- A. Clean exposed surfaces of acoustical ceilings, trim, edge moldings and suspension members to comply with manufacturer's instructions for cleaning.
- B. Touch up any minor finish damage.
- C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.4 PROTECTION

- A. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09510

CONFORMANCE SUBMITTAL
Section 09510 –Acoustical Ceiling

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Acoustical Tile:

- ☐ Armstrong "Cortega, Square Lay-In medium texture".
- ☐ Celotex "Baroque, medium texture".
- ☐ USG "Radar".

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL
Section 09510 –Acoustical Ceilings

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Heavy Duty Tile:

☐

USG Corporation

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

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SECTION 09 65 00 – VCT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.
- B. Related Documents
 - 1. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.
- C. Related Sections:
 - 1. Other Division 9 sections for floor finishes related to this section but not the work of this section
 - 2. Division 3 Concrete; not the work of this section

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
 - 2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
 - 3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
 - 4. ASTM F 1066 Standard Specification for Vinyl Composition Tile
 - 5. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
 - 6. ASTM F 1861 Standard Specification for Resilient Wall Base
 - 7. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - 8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
- B. National Fire Protection Association (NFPA):
 - 1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
 - 2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide flooring which has been manufactured, fabricated, and installed to performance criteria certified by manufacturer without defects, damage, or failure.
- B. Administrative Requirements
 - 1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.
 - 2. Pre-installation Testing: Conduct pre-installation testing as follows: [Specify testing (i.e., moisture tests, bond test, pH test, etc)]
- C. Sequencing and Scheduling
 - 1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.

2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.4 SUBMITTALS

- A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.
- B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.
- C. Submit Safety Data Sheets (SDS) available for adhesives, moisture mitigation systems, primers, patching/leveling compounds, floor finishes (polishes) and cleaning agents and Material Information Sheets for flooring products.
- D. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.
- E. Closeout Submittals: Submit the following:
 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
 2. Warranty: Warranty documents specified herein

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including moisture mitigation systems, primers, leveling and patching compounds, and adhesives.
- B. Select an installer who is experienced and competent in the installation of Armstrong resilient vinyl composition tile flooring and the use of Armstrong Flooring subfloor preparation products.
 1. Engage installers certified as Armstrong Commercial Flooring Certified Installers
 2. Confirm installer's certification by requesting their credentials
- C. Fire Performance Characteristics: Provide resilient vinyl composition tile flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
 1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
 2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
 3. CAN/ULC-S102.2 – Flame Spread Rating and Smoke Developed – Results as tested.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Comply with Division 1 Product Requirements Sections
- B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- D. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.7 PROJECT CONDITIONS

- A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65° F (18° C) and a maximum temperature of [100° F (38° C)] for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55° F (13° C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances. Refer to product installation recommendations for a complete guide on project conditions.

1.8 LIMITED WARRANTY

- A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.
- B. Limited Warranty Period: 20 years
- C. Limited Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.
- D. For the Limited Warranty to be valid, this product is required to be installed using the appropriate Armstrong Flooring Guaranteed Installation System. Product installed not using the specific instructions from the Guaranteed Installation System will void the warranty.

1.09 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Quantity: Furnish quantity of flooring units equal to 10% of amount installed.
 - 2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage, and protection of extra material.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Resilient tile flooring, wall base, adhesives and subfloor preparation products and accessories:

1. AHF Products, 3840 Hempland Road, PO Box 566, Mountville, PA USA 17554

2.2 RESILIENT TILE FLOORING MATERIALS

A. Provide Vinyl Composition Tile: Standard Excelon® Imperial® Texture Tile Flooring manufactured by AHF Products.

1. Description: Tile composed of polyvinyl chloride resin, plasticizers, fillers, stabilizers and pigments with colors and texture dispersed uniformly throughout its entire thickness.
2. Vinyl composition tile shall conform to the requirements of ASTM F 1066, "Standard Specification Vinyl Composition Floor Tile", Class 2, through-pattern
3. Pattern and Color: Soft Warm Gray #51861
4. Size: 12 in. x 12 in.
5. Thickness: 1/8 in

2.3 PRODUCT SUBSTITUTION

A. Substitutions: No substitutions permitted because of the specific attributes listed in Section 2.02.

2.5 ADHESIVES

A. Provide Armstrong S-1000 Flooring Adhesive under the flooring and Armstrong S-730 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer

2.6 ACCESSORIES

- A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Armstrong [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ patching and smoothing compound].
- B. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- C. Provide transition/reducing strips tapered to meet abutting materials.
- D. Provide threshold of thickness and width as shown on the drawings.
- E. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl, or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.
- F. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

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 (i.e., moisture tests, bond test, pH test, etc.).
- B. Visually inspect flooring materials, adhesives, and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.
- C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates regarding conditions existing at the time of installation.

3.3 PREPARATION

- A. Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong Flooring [S-194 Cement-Based Patch, Underlayment and Embossing Leveler / S-195 Underlayment Additive] [S-463 Level Strong™ cement based self-leveling compound] [S-466 Patch Strong™ patching and smoothing compound] [S-464 Prime Strong™ acrylic primer for porous substrates] [S-465 Prime Strong™ epoxy primer for non-porous substrates] as recommended by the flooring manufacturer. Refer to Armstrong Flooring Guaranteed Installation Systems and ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.
- B. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers, and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these contaminants are present on the substrate, they must be mechanically removed prior to the installation of the flooring material. Refer to the Armstrong Flooring Guaranteed Installation Systems and ASTM F 710 Standard Practice for

Preparing Concrete Floors to Receive Resilient Flooring for additional information on subfloor preparation.

- C. When using S-1000 Adhesive, perform subfloor moisture testing in accordance with [ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes"] [ASTM F 1869, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride"] and Bond Tests as described in "Armstrong Flooring Guaranteed Installation System" instructions to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. [Internal relative humidity of the concrete shall not exceed 100%.] [MVER shall not exceed 14 lbs./1000 sq. ft./24 hrs.] On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained
1. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring.

3.4 INSTALLATION OF FLOORING

- A. Install flooring in strict accordance with the latest edition of Armstrong Flooring Guaranteed Installation Systems. Failure to comply may result in voiding the manufacturer's warranty listed in Section 1.08.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

3.5 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths if practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.
- D. Apply [butt-type] [overlap] metal edge strips where shown on the drawings, [before] [after] flooring installation. Secure units to the substrate, complying with the edge strip manufacturer's recommendations.

3.6 CLEANING

- A. Perform initial and on-going maintenance according to the latest edition of the Maintenance Instructions for Vinyl Composition Tile.

3.7 PROTECTION

- A. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

END OF SECTION

CONFORMANCE SUBMITTAL
Section 09650 – VCT Flooring

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

VCT Floor Tile:

☐ AHF Products

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

SECTION 09651 - RESILIENT TILE FLOORING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Vinyl base.
 - 2. Vinyl reducer strips.

1.03 SUBMITTALS

- A. The General Contractor and the Sub-Contractor shall execute the provided Conformance Submittal for the product(s) specified.
- B. The General Contractor and the Sub-Contractor shall utilize ONLY the products as noted in this specification. NO SUBSTITUTIONS ALLOWED.

1.04 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 72 deg F or more than 95 deg F in spaces to receive floor tile for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods.
 - 1. After post installation period, maintain a temperature of not less than 72 deg F or more than 95 deg F.
- B. Install floor tile after other finishing operations, including painting, have been completed.
- C. All concrete surfaces that are to receive vinyl composition tile shall be inspected by the installing contractor, if found unsatisfactory the work of laying the vinyl composition tile shall not commence until the defective surfaces have been made satisfactory. Beginning work constitutes an acceptance of the base concrete flooring.

1.05 QUALITY ASSURANCE

- A. The work covered by this division of the specifications includes the furnishing of all labor, equipment, appliances, materials and the performing of all operations in connection with the laying, installing and finishing of all vinyl composition in strict accordance with the applicable drawings, schedules, and the approved samples and color selection.

1.06 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. Furnish one box for each 50 boxes or fraction thereof of each type, color, and pattern of floor tile.

PART 2 - PRODUCTS**2.01 VINYL COVE BASE**

- A. Vinyl cove base as manufactured by Armstrong, shall be furnished and installed around all walls as indicated in the Finish Schedule. All corners shall receive pre-molded inside/outside corner pieces matching adjacent base. Thickness shall be .080 inch. Base shall be adhered to the wall with Cove Base Cement per manufacturer's specifications.
- B. Height of the base shall be:
 - 1. 4 inches in all areas U.N.O.
 - 2. 6 inch base in Unisex and Toilets
- C. Vinyl Base Color: Armstrong Mid Gray.

2.02 VINYL REDUCER STRIP

- A. Vinyl reducer strip to exposed concrete shall be Armstrong Shadow Gray VT5, Roppe Dark Gray No. 150 #22, or similar color by other manufacturers listed above.

2.03 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement-based or blended hydraulic cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
- B. Before installing floor tile:
 - 1. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods. Do not use solvents.
 - 2. Floors must be dry, smooth, free of oil, grease, lumps or foreign matter. Specific instructions as published by the tile manufacturer must be followed. The floor tile shall be installed in a grid non-directional pattern.
 - 3. Use trowelable leveling and patching compounds to fill cracks, holes, and depressions in substrates.
 - 4. Move resilient floor tile and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by manufacturer. Install products only after they are at the same temperature as the space where they are to be installed.
 - 5. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tile widths at opposite edges of room are equal to one another and are at least one-half of a tile.
 - 1. Lay tiles square with room axis, unless otherwise indicated.
- D. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged.
 - 1. Pattern: Non-directional (grid pattern quarter turn).
- E. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- F. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, non-staining marking device.
- H. Install tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.
- I. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.02 CLEANING

- A. Immediately after installing resilient floor tile, the subcontractor for vinyl composition shall collect and remove from the site all debris resulting from vinyl composition installation and clean the floor to make it ready for sealing.
- B. The use of acids in any form is prohibited. The installing contractor will remove will excess adhesives and debris from floors using proper cleaning solutions as recommended by the manufacturer.

END OF SECTION 09651

CONFORMANCE SUBMITTAL
Section 09651 – Resilient Tile Flooring

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Vinyl Cove Base:

- ☐ Armstrong #64 Fresh Taupe (Lowes Special Order 89092)
- ☐ Johnsonite #80 Fawn
- ☐ Flexco #037 Dark Beige
- ☐ Roppe #P140 Fawn.

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

SECTION 09840 - ACOUSTICAL WALL TREATMENT (IF INDICATED ON DRAWINGS)

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes: Cementitious wood fiber plank acoustical Wall panel system and installation accessories.
- B. Related Sections:
 - 1. Division 9512 Section: Tile Ceilings.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E1264 Standard Classification for Acoustical Ceiling Products.
- B. Ceilings and Interior Systems Construction Association (CISCA):
 - 1. CISCA Code of Practices.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Provide acoustical wall panel assembly designed and tested to provide surface burning characteristics (ASTM E84) as follows:
 - a. Flamespread: 0.
 - b. Smoke Developed: 0.
 - 2. Provide acoustical wall panel system which has been manufactured, fabricated and installed to provide Noise Reduction Coefficient (NRC) rating as follows:
 - a. 0.85.

1.4 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
- B. Product Data: Submit manufacturer's product data and installation instructions.
 - 1. Recommended procedures for normal cleaning and removal of stains including precautions in use of cleaning materials that may be detrimental to surfaces.
- C. Samples: Submit selection and verification samples: 6 inch × 6 inch (152 × 152 mm) sample for each wall panel unit required, showing full range of exposed texture to be expected in completed work And One 8 inch × 10 inch (203 × 254 mm) sample for each fabric color is available.
- D. Quality Assurance/Control Submittals: Submit the following:
 - 1. Test Reports: Upon request, submit certified test reports from recognized test laboratories.
 - 2. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity.
- B. Regulatory Requirements and Approvals: Comply with requirements below.
 - 1. International Code Council (ICC):
 - a. ICC-ES Evaluation Report ESR-1112.
 - 2. Underwriters' Laboratories of Canada (ULC) label.
 - a. Structural Cement-Fiber Unit-535X

1.6 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 1 Product Requirement Section.
- B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
 - 1. Prevent soiling, physical damage or wetting.
 - 2. Store cartons open at each end to stabilize moisture content and temperature.

1.7 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install acoustical panels until building is closed in and HVAC system is operational.
 - 2. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
 - 3. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
 - a. Relative Humidity: 65 - 75%.
 - b. Uniform Temperature: 55 - 70 degrees F (13 - 21 degrees C).

1.8 MAINTENANCE

- A. Extra Materials: Provide A recommended percentage of 5% additional material for use by owner in building maintenance and repair.
- B. Provide new unopened cartons of extra materials, packaged with protective covering for storage, identified with appropriate labels.

PART 2 – PRODUCTS

2.1 ACOUSTICAL WALL PANEL SYSTEM

- A. Manufacturer: Tectum Inc.
 - 1. Contact: 105 South Sixth Street, Newark, OH 43055; Telephone: (888) 977-9691, (740) 345-9691; Fax: (800) 832-8869; E-mail: info@tectum.com; website: www.tectum.com.
 - 2. Tectum Standard Interior Wall Panels:
 - a. Material: Aspen wood fibers bonded with inorganic hydraulic cement.
 - b. Thickness: 1 inch (25.4 mm).
 - c. Edge: Long edge beveled.
 - d. Width: As indicated on drawings.
 - e. Length: As indicated on drawings.
 - f. Color: Natural. To be field painted.
 - g. Mounting Style: "C-40". Provide all fasteners, Furring strips and OCF 703 fiberglass insulation for a complete single source installation. Reference drawings for GC provided mounting hardware.

2.2 ACCESSORIES

- A. Provide accessories as follows:
 - 1. Tectum Painted Head Drywall Screws:
 - a. Material: Steel.
 - b. Length: 3 inches (76 mm).
 - c. Color: Natural.
 - 2. Tectum Moulding:
 - a. Material: Plastic.
 - 3. Tectum Touch-Up Paint:
 - a. Color: Natural.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Comply with the instructions and recommendations of the acoustical wall panel system manufacturer.
- B. Install materials in accordance with governing regulations, fire resistance rating requirements and industry standards applicable to work.
 - 1. Comply with CISCA Code of Practices.

3.2 EXAMINATION

- A. Site Verification of Conditions:
 - 1. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness that would affect quality and execution of work.
 - 2. Do not proceed with installation of wall panel system until unacceptable conditions are corrected.

3.3 INSTALLATION

- A. Screw head to be flush with panel surface.
- B. Securely affix wall panels by means of splines attached vertically to smooth wall or furring strips. Engage vertical kerfs on the edges of the wall panels with splines. Apply adhesive or use Velcro hook and loop fastening where necessary.
- C. Cover field cut edges by means of trim or other moldings.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel, trim, moldings and suspension members to comply with manufacturer's instructions for cleaning.
- B. Touch up any minor finish damage.
- C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.5 PROTECTION

- A. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09840

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SECTION 09911 - PAINTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. See Section 7 Joint Sealants.

1.2 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
- B. The work to be done by the painting contractor shall include the furnishing of all material, labor, tools and equipment required to complete the painting and finishing of the building as specified. Painting contract does not include shop coats. This contractor shall caulk around all exterior door and window frames in such a manner as to make them absolutely airtight.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For each type of finish-coat material and color chips indicated.
- C. Exterior wall coating submittal form.
- D. Painting contractor pre-qualifications.

1.4 QUALITY ASSURANCE

- A. General contractor shall schedule and coordinate an on-site pre-application meeting at least one (1) week prior to commencing work on this section. Notify Owner at least three (3) weeks in advance of meeting date. Required attendees will be Painting Contractor, General Contractor, Coating Manufacturer's Technical Representative and Owner. The agenda shall include:
 - 1. Apply block filler/surfacer and topcoat to a section of split-face wall (minimum 4'-0" x 6'-0" in size) in accordance with specifications and to the satisfaction of all attendees. Record project conditions and coverage site (for general information only). Upon approval, further work may proceed, and this sample shall establish standards (but not coverage rates), by which the work will be judged, and shall remain intact until the work is accepted.
 - 2. Review contract drawings, coating manufacturer's application requirements, status of coordinating work, availability and adequacy of materials, proposed schedule and application procedures.
 - 3. Record discussion including agreement/disagreement on matters of significance and furnish copies to each participant. If substantial disagreements exist, determine how these will be resolved and set date to reconvene meeting as appropriate.
- B. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5.
 - 1. Wall Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m).
 - 2. Small Areas and Items: Owner will designate items or areas required.
 - 3. Final approval of colors will be from benchmark samples.
- C. Inspections:
 - 1. The Coating Manufacturer's Technical Representative shall be on-site at the beginning of installations for both the exterior wall base and finish coat applications to insure the following:
 - a. The correct colors are on hand for use.
 - b. The correct types of coatings are on hand for use.
 - c. The wall conditions are reviewed with the applicator for manufacturer's compliance.
 - d. The coatings are being applied per manufacturer's recommendations.

2. The manufacturer's representative must fill out the "Exterior Wall Coating Submittal Form", found in this section, and turn it in to the General Contractor upon completion of work.
3. Graffiti Solution System by PROSOCO – (Al Morris, National Sales Manager (800) 255-4255, Fax: (800) 877-2700. Sure Klean Blok-Guard® & Graffiti Control II.), shall be applied only by licensed, certified applicators that are under contract with the manufacturer and that are recommended by the manufacturer for the application of the Graffiti Solution System. Applicators shall provide certificate signed and dated by the manufacturer prior to bid.

1.5 PROJECT CONDITIONS

- A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
- B. Apply paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.
- B. Paint Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 1. Sto Corp (Sto)- contact: Chuck Duffin (888) 786-3437
 2. PPG Architectural Finishes, Inc. (PPG) – contact: Rick Garlin (317) 318-5800
 3. Textured Coatings of America (TCA) for exterior tilt-up concrete only – contact: Richard Barnes 800-454-0340; Simon Reynolds, VP Commercial Sales (954) 205-5117
 4. Sherwin Williams (SW) – contact: Holt Faucette (407) 448-2359.
- C. Traffic Coating Manufacturer's Name:
 1. PPG "11-53 Zone Line Traffic and Zone Marking Paint".
 2. Sherwin-Williams "Setfast Acrylic Waterborne Traffic Marking Paint" (TM225-Yellow).

2.2 COLORS

- A. Exterior Colors:
 1. See drawings for locations, colors and manufacturers.
 2. If indicated on drawings, Lowe's Light Beige, Lowe's Medium Beige, Lowe's Dark Beige, Blue and Red are to be produced in accordance with each manufacturer's approved color formulation. Contact the manufacturer's national account representative for these formulas.
- B. Interior Colors
 1. See drawings for locations, colors and manufacturers.

2.3 COATINGS

- A. Exterior Masonry Waterproofing System Manufacturer: for colors Lowe's Light Beige or different colors as indicated on drawings.
 1. Sto Corp:
 - a. #520 Sto Prime Block Surfacers HP (**do not tint**), 1coat, 14-16 wet mils as block fill (more coats may be required for highly porous, rough, or irregular surfaces), 1 coat 4-6 wet mils as a primer
 - i White: NA13-0009

- b. #217 Sto Coat Lotusan, 2 coats (5-7 wet mils per coat)
 - i Lowe's Light Beige: NA12-0069
 - ii Lowe's Medium Beige: NA12-0067
 - iii Lowe's White: NA13-0009
- B. Exterior Masonry Waterproofing System Manufacturer for accent colors Lowe's Light Beige, Lowe's Medium Beige or different colors as indicated on drawings.
 - 1. Sto Corp:
 - a. #520 Sto Prime Block Surfer HP (do not tint), 1 coat, 14-16 wet mils as block fill (more coats may be required for highly porous, rough, or irregular surfaces), 1 coat 4-6 wet mils as a primer #520 Sto Prime Block Surfer HP needed only on masonry; Not required if over new or existing EIFS.
 - i 1) White: NA13-0009
 - b. #648 Sto Coat Acryl Plus, 2 coats (8-10 wet mils per coat)
 - i Lowe's Blue: NA12-0070
 - ii Lowe's Red: NA12-0071
 - c. #512 Sto Clear Coat Sealer, 2 coats (2-3 wet mils per coat)
- C. Interior Exposed Roof Structure: (office areas only)
 - 1. Exposed roof structure in office areas of building to be painted using the dryfall / dry fog application interior metal including decking, structural steel, joists framing, piping, etc.
 - a. PPG: Speedhide Super Tech Alkyd Dry-Fog # 6-151 XI, Eggshell or LEED compliant Version # 6-727XI4 Speedhide Super-Tech Latex Semi-gloss Dry Fog.
 - b. SW: Super Save-Lite Hi Tech Dryfall – B48 series, Eg-Shel or LEED compliant Pro Industrial Waterbased Dryfall, Eg-Shel – B42 series.
- D. Exterior Precast/Tilt-Up Concrete
 - 1. Sto Corp:
 - a. At smooth locations indicated on drawings:
 - i Exterior Primer: #805 Sto Hot Prime, 1 coat (4-6 wet mils)
 - ii Exterior Smooth Surface Finish: #217 Sto Coat Lotusan, 2 coats (5-7 wet mils per coat)
 - b. At textured location indicated on drawings:
 - i Exterior Primer: #805 Sto Hot Prime, 1 coat (4-6 wet mils)
 - ii Textured Surface Finish: #659 Sto Coat Texture Medium (applied at 50-75 SF per gal)
 - 2. Textured Coatings of America – TEX-COTE
 - a. At smooth locations indicated on drawings:
 - i TEX-COTE XL-70 Primer at 350-400 SF per Gallon
 - ii TEX-COTE 300 Smooth Coatings at approximately 50 +/- 5 SF per gallon.
 - b. At textured location indicated on drawings:
 - i TEX-COTE XL-70 Primer at 350-400 SF per Gallon
 - ii TEX-COTE 300 Textured Coatings at approximately 50 +/- 5 SF per gallon.
 - 3. Textured Coatings of America–TEX-COTE (If requested by Construction Project Manager)
 - a. At smooth locations indicated on drawings:
 - i TEX-COTE XL-70 Primer at 350-400 SF per Gallon.
 - ii TEX-COTE 70 Smooth Coatings at approximately 50 +/- 5 SF per gallon.

- b. At textured location indicated on drawings:
 - i. TEX-COTE XL-70 Primer at 350-400 SF per Gallon.
 - ii. TEX-COTE 70 Textured Coatings at approximately 50 +/- 5 SF per gallon.
- E. Interior Masonry, Precast and Tilt up Concrete System Manufacturers
 - 1. PPG Industries:
 - a. 1 Coat Speedhide 6-7 Latex Block Filler. (at masonry walls only)
 - b. 2 Coats Pro EV 12-110XI interior flat
 - 2. Sherwin Williams.
 - a. 1 coat PrepRite Block Filler B25 series. (at masonry walls only)
 - b. 2 coats ProMar 400 Zero Flat Latex – B30 series
- F. Interior Drywall System Manufacturers (Three coats per manufacturer's recommendations).
 - 1. PPG:
 - a. 1 coat Pro EV 12-900 Latex Primer Sealer
 - b. 2 coats Pro EV 12-510XI Interior Semi-Gloss Latex
 - 2. Sherwin Williams:
 - a. 1 coat ProMar 400 Zero Latex Primer – B28 Series
 - b. 2 coats ProMar 400 Zero Semi-Gloss – B31 Series
- G. Traffic Coatings:
 - a. H&C Concrete Sealer – Solid Color Solvent Based – note: sealers and curing agents MUST be removed prior to application. Refer to product data page for prep and applications recommendations.
- H. Exterior Ferrous Metal (including all exposed steel roof decking, structural steel, joists, framing, piping, etc.)
 - 1. Primer: PPG: 95-245 Rapid Coat DTR Epoxy (use for areas with rust, pitting or exposed metal rust. Complete prime on metal within 10 miles of coastal areas.
 - 2. Finish: PPG: Pitt Tech 90-812 EDF Series -Acrylic Semi-Gloss Dry Fog.
- I. Exterior Ferrous Metal (excluding fencing systems – see Sections 02822 and 02825).
 - 1. PPG: Pitt Tech Plus 90-110 Series. Acrylic Satin DTM
- J. Interior Ferrous Metal:
 - 1. PPG: Pitt Tech 90-374 Series. Interior/Exterior High Performance High Gloss DTM Industrial Enamel or PPG Pitt Tech 90-474 Series One Coat. Interior/Exterior High Performance Satin DTM Industrial Enamel.
- K. Graffiti Solution System Manufacturer: (if indicated on drawings for use on Pre-Colored Masonry and Brick only)
 - 1. PROSOCO – Al Morris, National Sales Manager (800) 255-4255, Fax: (800) 877-2700.
 - a. Sure Klean ® Weather Seal Blok-Guard® & Graffiti Control II. (for use on Pre-colored masonry and Brick)
 - b. Defacer Eraser® Sacrificial Coating SC-1 (for use on Painted Masonry)
 - 2. General Paint – GSS Graffiti Solution System – Gord Clark – Arch Account Manager 416-991-8499
- L. Exterior Wood Stain: (if indicated on drawings)
 - 1. Samuel Cabot – Semi-Transparent Stain.
 - 2. PPG – Flood Pro Series Semi-Transparent Acrylic/Oil Stain
 - 3. SW – Woodscapes Polyurethane Semi-Transparent Stain – A15 series.
 - 4. Color to later selection from manufacturer's standard range of colors.

M. Interior Epoxy System:

1. PPG:
 - a. 1 coat Speedhide 6-7 Latex Block Filler for block or 1 coat Pro EV 12-900 Latex Primer Sealer for drywall.
 - b. 2 coats Pitt-Glaze W.B. 1Precatalized Acrylic Epoxy (16-510 series).
2. Sherwin Williams:
 - a. 1 coat Preprite latex Block Filler (B25 Series) for block or 1 coat ProMar 400 Zero Latex Primer (B28 Series) for drywall.
 - b. 2 coats Industrial Pre-Catalyzed Epoxy Semi-Gloss – K46 series.

2.4 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- C. Colors: As indicated on drawings.

2.5 PREPARATORY COATS

- A. The contractor shall be wholly responsible for the finish of this work, and shall not commence any part of it until surface is in proper condition.
- B. All knots or sappy spots shall be given one coat of shellac before painting. All necessary puttying of nail holes, cracks and blemishes shall be done after priming coat has become hard and dry and before second coat is applied. All greasy or oily metal surfaces shall be cleaned with solvent before applying any materials. All scale or rust shall be removed by scraping or wire brushing.
- C. Any unprimed steel, galvanized steel, or Galvalume steel shall be prepared by solvent methods in accordance with paint manufacturer's recommendations.

PART 3 – EXECUTION

3.1 Painting Contractor Pre-Qualifications

- A. The Contractor shall demonstrate capability to execute this contract by submitting the following:
 1. Contractor shall have been in the commercial painting business for a minimum of 5 years.
 2. Listing of at least three references with prior jobs completed of similar size, structure and coating requirements and list similar project experience.
 3. The Contractor shall use only skilled workmen who are trained and experienced in the necessary crafts and familiar with the specifications and methods needed to properly perform the work required by this project.

3.2 APPLICATION

- A. The following requirements shall be met in addition to those of the manufacturer:
 1. Block wall Surfaces:
 - a. Apply blockfiller/surfacer with airless spray followed by a double backroll to insure proper fill and appearance. Filler/surfacer coat shall be virtually pin-hole free. Areas exhibiting more than ten (10) pinholes per block shall be recoated.
 - b. Topcoat shall be applied with airless spray followed by a double backroll to insure proper build and appearance. All "running" shall be eliminated by backrolling. Topcoat shall be virtually pin-hole free. Areas exhibiting more than ten (10) pinholes per block shall be recoated. Roller strokes shall be indiscernible.

2. Contractor shall be responsible for a thorough and complete application as required by these specifications regardless of coverage rates which may be suggested by the manufacturer.
- B. Comply with procedures specified in Painting and Decorating Contractors of America (PDCA) P4 "responsibilities for inspection and acceptance of surfaces to be painted."
- C. All work shall be done in a workmanlike manner by skilled mechanics. All materials shall be properly applied and shall be free from runs or sags. No paint, varnish or enamel shall be applied until preceding coat is thoroughly dry and hard.
- D. In general and unless otherwise specified, exterior oil paints shall be allowed to dry at least 48 hours between coats; interior paints at least 24 hours between coats. Enamel and varnish shall be allowed to dry at least 48 hours between coats and shall be sanded lightly between coats with #00 sandpaper and dusted before succeeding coat is applied. After applying paste wood fillers, excess shall be carefully and neatly cleaned from surface by rubbing across grain. All nail holes shall be filled with putty or other approved filler, tinted to match finish.
- E. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- F. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- G. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - c. If transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
 - f. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Society for Protective Coating's (SSPC) recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire- brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

- d. All unprimed exposed metal shall be given a prime coat of metal primer and two top coats. Metal arriving at the job with shop prime coat applied shall be carefully sanded and all bare spots reprimed before painting. Interior hollow metal door/frames, and other interior exposed metal surfaces shall be painted as indicated on drawings.
 5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
 6. Gypsum Wallboard: All gypsum wallboard shall be given a minimum of two coats of paint. Additional coats may be required to achieve acceptable coverage. See drawings for paint types and colors.
 7. Low Temperature coatings have specific manufacturer requirements, refer to product data PRIOR to installation of materials.
- H. Material Preparation:
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
- I. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convactor covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 2. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 3. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
- J. Sand lightly between each succeeding enamel or varnish coat.
- K. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Omit primer over metal surfaces that have been shop primed and touchup painted.
 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
- L. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- M. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- N. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- O. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- P. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- Q. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- R. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

3.3 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing, or replacing, and repainting, as approved by the Owner.
- C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.4 EXTERIOR PAINT SCHEDULE (also see drawings)

- A. Concrete Unit Masonry:
 - 1. Surface Preparation: All interior and exterior CMU shall be free from dirt, loose or excess mortar, and thoroughly dry before painting. For elastomeric exterior systems, painting of CMU may proceed 30 days after installation under normal drying conditions. For Loxon system, refer to manufacturer's recommendations for surface curing and dryness requirements prior to application. All CMU shall be free of visible efflorescence prior to painting. See Division 4. for efflorescence removal.
- B. Ferrous Metal (including all exposed metal under Garden Center roof and Customer Loading Canopy roof):
 - 1. Direct to Metal (DTM) Acrylic Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Exterior ferrous-metal primer (not required on shop-primed items).
 - b. Finish Coats: Exterior semigloss DTM acrylic enamel.
- C. Zinc-Coated Metal:
 - 1. Direct to Metal (DTM) Acrylic Finish: Two finish coats over a galvanized coat and metal primer.
 - a. Primer: Exterior galvanized metal primer.
 - b. Finish Coats: Exterior semigloss DTM acrylic enamel.

3.5 EGRESS PATHS IN WAREHOUSE AREA ON CONCRETE (and other interior locations, as indicated on drawings):

- A. Paint unobstructed path, as indicated on drawings.
- B. Paint shall be applied in two (2) coats to a clean, dry surface, per manufacturer's recommendations.

3.6 EXTERIOR MASONRY WATERPROOFING SYSTEM (AS INDICATED ON DRAWINGS)

- A. General Description: Furnish all materials and labor for complete and through application of waterproofing system as described herein to all above-grade exterior masonry surfaces.

3.7 DRYFALL / DRY FOG / DRY DROP APPLICATION

- A. Surfaces to be finished must be clean, dry, and free of dirt, oils, or other contaminants.
- B. Application shall be conventional spray gun or airless spray pump. Do not apply when atmospheric or surface temperature is below 50 degrees F.
- C. Contractor shall insure all areas to be painted are covered and touched up as required. All surfaces surrounding painted areas shall be fully protected from accidental spraying.
- D. Contractor shall clean up paint residue on walls and floors prior to end of working day.

3.8 SURFACES NOT TO BE PAINTED

- A. Acoustical tiles, vinyl floor tile, aluminum, U.L. equipment and stainless-steel metal equipment shall receive no paint. All paint spots shall be removed from the above surfaces.

3.9 ANTI-GRAFFITI COATING (if indicated on drawings)

- A. Deliver materials to the job site in the manufacturer's original, new, unopened packages, and containers bearing manufacturer's name and label.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign material and residue.
- C. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C)
- D. Do not apply coatings in snow, rain, fog, or mist; when the relative humidity exceeds 85 percent; when temperature is less than 50 deg F (3 deg C) above the dew point; or to damp or wet surfaces. (Exception: low temperature systems may be used upon approval by Lowe's project manager as directed in accordance with manufacturer's recommendations.)
 - 1. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.
- E. Examine substrates and conditions under which coatings will be applied for compliance with requirements on applying coatings. Surfaces to receive coatings must be thoroughly dry before coatings are applied.
 - 1. Do not proceed with coating application until unsatisfactory conditions have been corrected.
 - 2. Start of application will be construed as the applicator's acceptance of surfaces within that particular area.
- F. Cleaning: Before applying coatings or other surface treatments, clean the substrates of substances that could impair bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and coating application so dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.
- G. Cementitious surfaces: Prepare concrete, concrete masonry block, cement plaster, and similar surfaces to receive special coatings. Remove efflorescence, chalk, dust, dirt, grease, oils and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve concrete curing, use mechanical methods to prepare surfaces.
 - 1. Use abrasive blast-cleaning methods if recommended by the coating system manufacturer.
 - 2. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish coats to blister and burn, correct this condition before application. Do not apply coatings over surfaces where the moisture content exceeds that permitted in the manufacturer's printed directions.
- H. Material Preparation: Carefully mix and prepare materials according to the coating manufacturer's directions.
 - 1. Maintain containers used in mixing and application of coatings according to the manufacturer's directions.
 - 2. Stir materials before applying to produce mixture of uniform density; stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain the coating material before using.
- I. General: Apply special coatings by brush, roller, spray, squeegee, or other applicators according to the manufacturer's directions. Use brushes best suited for the material being applied. Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 - 1. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
- J. Minimum Coating Thickness: Apply each material no thinner than the manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by the manufacturer.
- K. Cleanup: At the end of each work day, remove rubbish, empty cans, rags and other discarded materials from the site
- L. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as acceptable to the owner. Leave in an undamaged condition.

3.10 WARRANTY/GUARANTEE

- A. Contractor shall guarantee that all labor and materials provided shall be of first quality, in full compliance with the requirements of the Contract Documents, and free from defect for a period of one (1) year from date of Final Acceptance of the work.
- B. Contractor shall be obtain from the manufacturer of the exterior wall coating system a written warranty which warrants to the Building Owner for a period of five (5) years (and/or specific product warranty extensions for 10 years as applicable) from the date Final Acceptance of the work that the exterior coating system shall be free of defects in manufacture and the surface coating will not sustain peeling, cracking or blistering, excessive chalking, excessive chipping, excessive fading (per defined standards for specific products), nor allow water penetration, under ordinary wear. This warranty shall provide for sufficient materials (and labor as applicable to specific products) to replace products which fail to meet these requirements.

3.11 CLEANING

- A. The contractor shall be responsible for the condition of building to his charge. He shall protect adjacent work and materials from soiling or damage as well as his own. Upon completion of all painting work, the contractor shall remove all paint from doorknobs, floors, counter tops and other areas not requiring paint. Touch up all scuff marks and make the whole project in first class condition. Remove all equipment, debris, and surplus materials.

END OF SECTION 09911

**EXTERIOR WALL COATING
SUBMITTAL FORM**

Project: **City:**
General Contractor:
Paint Manufacturer:
Paint Mfr. Rep. Name: **Phone #**
Paint Contractor:
Paint Contractor's Address:
Paint Contr. Contact Name: **Phone #**

SURFACE PREPARATION (prior to application)

Type of Surface to be coated (Block, Pre-Cast Conc., Tilt-Up Conc., etc.)

Signature of approval accepting surface for application:

(Paint Contractor)

Date

PRIMER/BLOCK FILLER (do not tint)

Product to be applied:
Area to be covered (s.f.):
Gallons to be used:

Product applied per specification:

(Paint Contractor)

Date

Approved specified product supplied:

(Manufacturer)

Date

Date Application Started:
Weather Conditions:
Expected 24 hr. High Temp.:

Expected 24 hr. Low Temp.:

FINISH COATING SYSTEM

Product to be applied:

Color:	Area of coverage (s.f.):	No. coats:
	Gallons to be used:	(per coat)
	Wet Mil Thickness:	
Color:	Area of coverage (s.f.):	No. coats:
	Gallons to be used:	(per coat)
	Wet Mil Thickness:	

Color:

Area of coverage (s.f.):

No. coats:

Gallons to be used:

(per coat)

Wet Mil Thickness:

Weather Conditions:

Expected 24 hr. High Temp.:

**Wet Mil Thickness Average at
Test Locations(4 locations per
wall):**

Expected 24 hr. Low Temp.:

SECTION 10113 - TOILET COMPARTMENTS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-polymer toilet compartments configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" for toilet compartments designated as accessible.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Adhesives: Manufacturer's standard product that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 SOLID-POLYMER UNITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide 1" thick HDPE solid color or comparable product by one of the following:
 1. Metpar Corp. Basis of Design
 2. Bradley Corporation; Mills Partitions
 3. Accurate Partitions Corporation.
 4. Ampco, Inc.
 5. Comtec Industries/Capitol Partitions.
 6. General Partitions Mfg. Corp.
 7. Hadrian Manufacturing Inc.
 8. Knickerbocker Partition Corporation.
 9. Partition Systems Incorporated of South Carolina.
 10. Rockville Partitions Incorporated.
 11. Santana Products, Inc.
- B. Toilet-Enclosure Style: Overhead braced and Floor anchored.
- C. Urinal-Screen Style: Wall hung

- D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.
 - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
 - 2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless- steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
 - 3. Color: Basis of Design - #P700 Grey Dawn
- E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.
- F. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 - 1. Material: Stainless steel
 - 2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees
 - 3. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
 - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant- type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

- A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-(610-mm-) wide, in- swinging doors for standard toilet compartments and 36-inch-(914-mm-) wide, out-swinging doors with a minimum 32-inch-(813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
- B. Clearances: Maximum 1/2 inch (13 mm) between pilasters and panels; 1 inch (25 mm) between panels and walls.
- C. Pilasters will be anchored to the floor using 3/8" treaded rods, hex nuts and washer to provide for floor adjustment.
- D. The general contractor shall inspect every door, pilaster, partition and accessory upon delivery to the job site to insure its workmanship, quality and that the material is free from all defects. The Owner will not accept any materials damaged and/or repaired.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10113

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SECTION 10522 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

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 DESCRIPTION OF WORK:

- A. Extent of fire extinguishers, cabinets and accessories is indicated on drawings.
- B. Definition: "Fire extinguishers" as used in this section refers to units which can be hand-carried as opposed to those which are equipped with wheels or to fixed fire extinguishing systems.

1.3 QUALITY ASSURANCE:

- A. Single Source Responsibility: Obtain products in this section from one manufacturer.
- B. UL-Listed Products: Provide new portable fire extinguishers which are UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.
- C. Environmental Standards: Coating materials shall comply with provisions of the following:
 - 1. Environmental Protection Agency (EPA) National Volatile Organic Compound (VOC) Emission Standards for Architectural Coatings, unless more stringent standards are required by authorities having jurisdiction.

1.4 SUBMITTALS:

- A. Product Data: Submit product data for each type of product included in this section. For fire extinguisher cabinets include roughing-in dimensions and details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, and panel style and materials.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. J.L. Industries.
 - 2. Larsen's Mfg. Co.
 - 3. Muckle Manufacturing, Division of Technico, Inc.
 - 4. Potter-Roemer

2.2 FIRE EXTINGUISHERS:

- A. General: Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard which comply with requirements of governing authorities.
 - 1. Abbreviations indicated below to identify extinguisher types related to UL classification and rating system and not, necessarily, to type and amount of extinguishing material contained in extinguisher.
 - a. Multi-Purpose Dry Chemical Type: UL-rated 4A-60BC, 10 lb. nominal capacity, in enameled steel container, for Class A, Class B and Class C fires.

2.3 MOUNTING BRACKETS:

- A. Provide manufacturer's standard bracket designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.
 - 1. Provide brackets for extinguishers not located in cabinets.

2.4 FIRE EXTINGUISHER CABINETS SEMI-RECESSED:

- A. General: Provide fire extinguisher cabinets where indicated, of suitable size for housing fire extinguishers of types and capacities indicated, or if not indicated, sized to house MP10 multi-purpose dry chemical type fire extinguisher.
- B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.
- C. Cabinet Type: Suitable for mounting conditions indicated, of the following types:
 - 1. Semi-Recessed: Cabinet box (tub) partially recessed in walls of shallow depth.
 - a. Provide recessed door handle for semi-recessed cabinet as required for ADA compliance.
- D. Trim Style: Fabricate trim in one piece with corners mitered, welded and ground smooth.
 - 1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - a. Square-edge Trim: Square edges with backbend depths as follows:
 - i Return Trim: 1-1/4" to 1-1/2" for semi- recessed cabinet.
 - b. Trim Metal: Of same metal as door.
- E. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
 - 1. Enameled Steel: Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.
- F. Door Style: Manufacturer's standard design as indicated below and on drawing.
 - 1. Bubble Type: One-piece molded clear plastic.
- G. Door Hardware: Provide manufacturer's standard door operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous type hinge permitting door to open 180.

2.5 FIRE EXTINGUISHER CABINETS - SURFACE MOUNTED:

- A. General: Provide fire extinguisher cabinets where indicated, of suitable size for housing fire extinguishers of types and capacities indicated, or if not indicated, sized to house MP10 multi-purpose dry chemical type fire extinguisher.
- B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.
- C. Cabinet Type: Suitable for mounting conditions indicated, of the following types:
 - 1. Surface Mounted: Cabinet box (tub) fully exposed on walls and finished all sides.
- D. Trim Style: Fabricate trim in one piece with corners mitered, welded and ground smooth.
 - 1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - a. Rolled-Edge Trim: Rounded edges with backbend depth as follows:
 - b. Trim Metal: Of same metal as door.

- E. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
 - 1. Enameled Steel: Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.
 - 2. Door Glazing: "Break Glass" type.

F. Hardware and Accessories:

- 1. Provide key lock.
- 2. Provide hammer to "break glass" with chain attachment.

2.6 FACTORY FINISHING OF FIRE EXTINGUISHER CABINETS:

- A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations except as otherwise indicated. Apply finishes in factory after products are assembled. Protect cabinets with plastic or paper covering, prior to shipment.
 - 1. Painted Finishes: Provide painted finish to comply with requirements indicated below for extent, preparation and type:
 - a. Extent of Painted Finish: Apply painted finish to both concealed and exposed surfaces of cabinet components except where other than a painted finish is indicated.
 - b. Color: Provide color or color matches indicated, or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
 - c. Preparation: Clean surfaces of dirt, grease, and loose rust or mill scale.
 - d. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply cabinet manufacturer's standard baked enamel finish system to the following surfaces:
 - i Interior of cabinet.
 - ii Exterior of cabinet except for those surfaces indicated to receive another finish.
 - 2. Field-Paintable Factory Finish: Immediately after cleaning and pretreatment, apply to surfaces indicated below, manufacturer's standard factory-applied paint system which is suitable, after deglossing, as an undercoat for field-applied paint system specified in Division-9 section "Painting":
 - a. Exterior of cabinet except for those surfaces indicated to receive another finish.

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - 2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
 - 3. Where exact location of bracket mounted fire extinguishers is not indicated, locate as directed by Architect.

3.2 IDENTIFICATION:

- A. Identify bracket-mounted extinguishers with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface. Letter size, style and location as selected by Architect. Coordinate requirements with local jurisdiction.
 - 1. At extinguishers mounted to free standing column, provide four (4) identifying signs, with red lettering, located one on each side of the column.

END OF SECTION 10522

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SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Toilet and bath accessories.
 - 2. Warm-air dryers.

1.3 SUBMITTALS

- A. The General Contractor and the Sub-Contractor shall execute the provided Conformance Submittal for the product(s) specified.
- B. The General Contractor and the Sub-Contractor shall utilize ONLY the products as noted in this specification. NO SUBSTITUTIONS ARE ALLOWED.

1.4 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace mirrors that develop visible silver spoilage defects within 15 years from date of Final Acceptance.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. For Lowe's National Account Pricing General contractor contact:
 - a. Joe Harrell, Director National Business Development, Cook and Boardman
P (336) 413-7050
- B. Basis-of-Design Products: The design for toilet and bath accessories as described in Part 2 are based on products indicated. Subject to compliance with requirements, provide the named product of the following:
 - 1. Electrical Hand Dryers:
 - a. World Dryer SLIMdri (Item# L-974A, Product Code – 2922735).
 - 2. Grab Bars:
 - a. ASI 3801 x 42 , concealed mounting kit.
 - 3. Toilet Paper Dispenser:
 - a. Bunzl Model #15400551, Jumbo Toilet Paper Dispenser.
 - 4. Napkin Disposal:
 - a. American Specialties, Inc. (ASI) #0852
 - 5. Metal Framed Mirrors:
 - a. Mirrors shall be ¼ inch thick, No. 1 quality polished plate glass of sizes shown on drawings. Mirrors shall be manufactured with two coats of silver, electro-copper clad. Mirrors shall carry a fifteen-year guarantee against silver spoilage. Mirror frames shall be fabricated of satin finish. Concealed mounting shall be provided
 - 6. Paper Towel Dispenser:
 - a. Bunzl, Model #15409990 Paper Towel Dispenser.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19, ASTM B 16 (ASTM B 16M), or ASTM B 30 castings.
- C. Steel Sheet: ASTM A 366/A 366M, 0.0359-inch (0.9-mm) minimum nominal thickness.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).
- E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.
- G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
- H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.
- J. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 – EXECUTION

- A. It shall be the General Contractor's responsibility to insure that proper blocking has been installed prior to wall finish applications, in order to achieve secure mounting of all items listed in this section.
- B. Install accessories using fasteners appropriate for substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- C. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.
- D. At each handicapped toilet, furnish and install grab bars as shown on the drawings. Location and height of grab bars shall be as indicated on drawings.
 - 1. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

END OF SECTION 10801

CONFORMANCE SUBMITTAL
Section 10801 – Toilet and Bath Accessories

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Electrical Hand Dryers:

☐ World Dryer SLIMdri (Item# L-974A, Product Code – 2922735)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL
Section 10801 Toilet and Bath Accessories

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Grab Bars:

☐

ASI, Model # 3801, sizes and quantity as indicated on plans. Includes concealed mounting hardware

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

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Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL
Section 10801 Toilet and Bath Accessories

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Toilet Tissue Holders:

☐

Bunzl Model # 15400551, Jumbo Bath Tissue Dispenser.

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL
Section 10801 – Toilet and Bath Accessories

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product of each type listed has been selected (check one box for each type) for use in this project from the list of acceptable products specified:

Sanitary Napkin Disposal:

☐

American Specialties, Inc. (ASI) # 0852

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL
Section 10801 Toilet and Bath Accessories

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product of each type listed has been selected (check one box for each type) for use in this project from the list of acceptable products specified:

Horizontal Baby Changing Station:

☐

American Specialties, Inc. (ASI) #9012

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL
Section 10801 Toilet and Bath Accessories

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Metal Framed Mirrors:

☐

ASI, Model #0620 Framed Mirror _____

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

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Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

CONFORMANCE SUBMITTAL
Section 10801 Toilet and Bath Accessories

Lowe's of _____
(City, State)

General Contractor: _____
(Company Name)

(Address, Phone Number)

Sub-Contractor: _____
(Company Name)

(Address, Phone Number)

The following product has been selected (check one box) for use in this project from the list of acceptable products specified:

Paper Towel Dispenser:

☐

Bunzl Model # 154009990 Paper Towel Dispenser

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

General Contractor: _____
(Signature of the Authorized Agent of the General Contractor)

(Print Name of the Authorized Agent of the General Contractor)

I represent to Lowe's that the product selected will be installed in compliance with the applicable codes for the authorities having jurisdiction and in accordance with the project specification. If noncompliance is discovered the General Contractor shall make or cause to be made all necessary corrections to meet the applicable codes and specifications. Immediately or as directed by Lowe's the work shall be completed without additional cost to the Lowe's and / or the contract.

Sub-Contractor: _____
(Signature of the Authorized Agent of the Sub-Contractor)

(Print Name of the Authorized Agent of the Sub-Contractor)

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SECTION 11160 - LOADING DOCK EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Edge of Dock Levelers.
 - 2. Pit Levelers with all necessary controls.
 - 3. Dock shelters.
 - 4. Dock Seals
 - 5. Laminated-tread dock bumpers
 - 6. Leveler Pan Unit (if indicated on drawings)
 - 7. Door Track Guards
 - 8. Scissor Gate
- B. See Division 16 Sections for electrical wiring and connections.

1.3 SUBMITTALS

- A. Product Data: For each type of loading dock equipment indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for stationary loading dock equipment.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawing: Upload to Site / Folio (www.sitefolio.net), Include pit plans, elevations, sections, details, wiring diagrams, and attachments to other work including dimensions, wiring diagrams, and rough-in dimensions as well as any conduit runs.
 - 1. Provide templates for anchors and bolts anchored to permanent construction.
- C. Maintenance data.
- D. Manufacturer's Installation Instructions.
- E. Informational Submittals
 - 1. Qualification Data: For Installer.
 - 2. Welding certificates.
 - 3. Sample Warranty: For manufacturer's special warranty

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer, approved by manufacturer to install and maintain manufacturer's products.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Dock-Leveler Standard: Comply with MH 30.1, "Safety, Performance, and Testing of Dock Leveling Devices."

PART 2 – PRODUCTS

2.1 MANUFACTURERS: Select from manufacturers below or an approved equal.

- A. Basis of Design: Blue Giant.
- B. Kelley.
- C. Serco.
- D. APS.

2.2 PRODUCTS: Basis of design

- A. Edge of Dock Leveler:
 - 1. Blue Giant: Model MDC7230M
- B. Pit Leveler (Air Bag):
 - 1. Blue Giant: Model AB6008-45
- C. Dock Shelters:
 - 1. Blue Giant: Model BGDSHS
- D. Dock Seals:
 - 1. Blue Giant: Model BGDSC
- E. Steel Faced Bumpers
 - 1. APS Laminated Bumper.
- F. Leveler Pit Pan (if indicated on drawings)
 - 1. Allied Solutions, W194 N11481 McCormick Dr. P.O. Box 309, Germantown, WI 53022, Phone: 1.800.643.5424, Fax: 262.255.4199
- G. Door Track Guards
 - 1. APS: Track Sentury.
- H. Folding Security Gate / Scissor Gate
 - 1. Uline H-4893

2.3 EDGE-OF-DOCK LEVELERS

- A. Type: Surface-mounted, hinged-lip-type, edge-of-dock levelers designed for permanent installation on face of dock platform without concrete pit forming.
 - 1. Ramp Width: 84 inches (1829 mm).
- B. Function:
 - 1. Vertical Travel: Minimum working range of 5 inches (127 mm) above and 5 inches (127 mm) below adjoining platform level and an operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact.
 - 2. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed compensates automatically for upward or downward movement of truck bed during loading and unloading.
 - 3. Automatic Lateral Compensation: Tilting of ramp with lip extended and resting on truck bed compensates automatically for canted truck beds of up to 3 inches (76 mm) over width of ramp.

4. Lip Operation: Manufacturer's "Never Lift" lift mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs.
 - a. Length of Lip Extension: Not less than 15 inches (381 mm) from ramp edge and not less than 12 inches (305 mm) in front of dock bumpers.
 5. Automatic Ramp Return: Of unloaded ramp, from raised or lowered positions to stored position, level with platform, as truck departs. Leveler shall be able to be retracted to stored position while truck is at dock.
- C. Operation:
1. Mechanical Operating System: "Never Lift" lifting mechanism and hand lowering of unloaded ramp. Equip units with a spring counterbalancing mechanism.
 - a. Lever Handle: Lever handle for raising unloaded ramp with minimal lifting force. Push lever forward to extend lip and lower ramp.
 - b. Removable Lifting Handle: Removable lifting handle for raising unloaded ramp by lifting action.
- D. Rated Capacity: Dock levelers shall be capable of supporting a total gross load indicated below without permanent deflection or distortion.
1. Capacity – 30,000 lbs. (Letter Rating not acceptable under ANSI MH14.1 1987 standard.).
- E. Safety Devices:
1. Maintenance Strut: Integral strut to positively support ramp in up position during maintenance of dock leveler.
 2. Safety tread plate to be an integral part of the top portion of bumper block assemblies for edge of dock.
- F. Construction: Fabricate dock-leveler frame from structural- and formed-steel shapes. Fabricate platform, including hinged lip, from nonskid steel plate. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles. Grease fittings to be provided on hinge tubes. Heavy duty bumper blocks and patented "Never Lift" style push/pull lever to be included (lifting hook is not acceptable). Include two dock bumpers attached to frame.
- G. Finish and Color: Manufacturer's standard paint applied to factory-assembled and -tested edge of dock levelers before shipping. Paint to comply with ANSI Z535.1. All other surfaces to be painted in manufacturer's standard color.

2.4 PIT LEVELER (AIR BAG)

- A. Lug hinge style hinged lip, hydraulic powered dock leveler meeting the following requirements.
1. Nominal Size: 6 feet wide and 8 feet long.
 2. Capacity 45,000 lbs. (Letter Rating not acceptable under ANSI MH 14.1 1987 standard)
 3. Service Range 12 inches above dock level and 12 inches below dock level.
 4. Dock leveler lip to meet ANSI MH14.1 1987 standard for maximum available service to most standard trailers with standard 16" leveler lip.
 5. Leveler to include two 4.5 standard laminated bumpers.
 6. Leveler to include Rubber or Brush weather seal (three sided weather seal protection).
- B. Leveler Function:
1. Leveler to be 115 volt single phase (electrical connections by electrical contractor)
 2. Leveler to be single pushbutton operated.
 3. Leveler to be Pneumatic platform and lip.

4. Equipment:

- a. Curb Angles: Eight pieces, 3"x3"x3/16" minimum, to cover all exposed edges of dock leveler pit and forward dock edge as required for bumper mounting. (furnished by General Contractor).
- b. Leveler;
 - i Ramp: Reinforced torsionally compliant ramp construction. To include structural full operating range toe guards with Safety Yellow.
 - ii Lip: To be safety tread plate minimum of 50,000/55,000 psi yield strength. Hinge pin to be continuous across front of leveler supported by lug supports. Lip hinge pin to be full width.
 - iii Free Fall Protection: Velocity fuse fail safe system built into hydraulic system to provide safety protection in free fall situation. Leveler will lock up and hold within up to full rated capacity of leveler.
 - iv Lifting System: Ramp powered by air bag that controls complete function of dock leveler ramp. Lip is lifted in conjunction with ramp.
 - v Night Locks: Night locks are the built in lip keepers that keep platform in safe cross traffic position.
 - vi Finish: Manufacturers standard rust inhibiting paint finish acceptable for structural ramp and sub frame

2.5 DOCK SHELTERS

A. General:

- 1. Provide the manufacturers standard dock shelter consisting of rigid head and side frames with flexible coated fabric head and side curtains. Head and side curtains shall include flexible "Scotchply" stays to ensure that pressure is maintained on the top and sides of the truck body, while providing unobstructed accessibility to the interior of the vehicle.

B. Size of Unit:

- 1. Unless otherwise indicated unit shall have the following minimum overall dimensions: 11'-6" wide x 11'-0" high x 24" top/30" bottom projection or 11'-6" wide x 11'-0" high x 18" top/24" bottom projection to suit the dock conditions and shall be designed to effectively service vehicle heights ranging from 12'-6" to 13'-6".

C. Construction: Provide the manufacturer's standard construction consisting of:

- 1. Three rigid, pressure treated, kiln dried before and after treating, structural wood frames, having translucent fiberglass secured to the exterior.
- 2. The head and side frames shall be assembled with screw shank nails and countersunk lag screws.
- 3. The exterior fiberglass shall be secured to the frames with self sealing wood screws (stapled not acceptable).
- 4. The 2" x 6" head frame shall be sloped from the center to provide for adequate drainage.
- 5. Exterior head and side frame corners shall be trimmed with aluminum angle, that is through bolted to the frames, through the aluminum trim, the grommet in the fabric and the stay (lag screw attachment not acceptable).
- 6. One pair of fabric covered polyurethane foam bottom pads of an 8" to 2" wedge design to be furnished per shelter.
- 7. All hardware to have a rust resistant coating.
- 8. Unit to include two factory painted steel guards constructed of 6" channel 8.2# per foot.
- 9. Side curtain edges to encase a continuous, compressible closed cell neoprene cord.
- 10. The top portion of each side curtain shall be supported vertically by the means of "Scotchply" stays constructed in a full "Z" pattern.
- 11. The head and side curtains shall be equipped with 3-M "ScotchplyTM" stays (pultruded fiberglass, steel or plastic not acceptable). Each stay shall be encased by multi-ply fabric sleeves. Stays to be spaced evenly with a maximum of 16" O.C. in side curtains and a 20" maximum O.C. in head curtain.
- 12. Wind straps shall be included to protect head curtain from wind damage.
- 13. Tensions cords in the side curtains shall be included to maintain curtain stability.
- 14. Curtain fabric, pleats and reinforcing fabric to be mechanically stitched together having 5 to 5½ stitches per inch, all independently locked with proper tension with beginning and ending of all continuous stitch runs having a minimum of 6 stitches of backtaking.

- D. Curtain Fabric: Provide Dynalon coated nylon or polyester fabric with a total minimum weight of 45 oz. per sq yd having the following minimum property values in compliance with Federal Testing Standard 191:

	TEST METHOD	RESULTS
1.	Tear Strength Per Lbs/Method 5134	300 x 300
2.	Abrasion Resistance Cycles/Method 5306	
a)	H-22 Wheel, 1000 Gram Load, End Point - First Exposure to Base Fabric	6000
3.	Tensile Strength Per Lbs/Method 5100	1200 x 1200
4.	Cold Resistance at -40oF/Method 5874	Pass
5.	Adhesive Lbs. per 1" strip/Method 5950	20

- E. Reinforcing: Provide pleated protectors at each end of the head curtain in the form of overlapping layers of coated fabric attached to the head curtain cover fabric with each overlapping pleat having 6" of exposure. Provide multi-ply reinforcement panels of coated fabric attached to the lower portion of the side curtain cover fabric. Pleated protectors and bottom reinforcement panels shall be of Dynalon coated nylon or polyester with a total minimum weight of 45 oz per sq yd having the following minimum property values in compliance with Federal Testing Standard 191:

	TEST METHOD	RESULTS
1.	Tear Strength Per Lbs/Method 5134	300 x 300
2.	Abrasion Resistance Cycles/Method 5306	
3.	H-22 Wheel, 1000 Gram Load,	
4.	End Point - First Exposure to Base Fabric	6000
5.	Tensile Strength Per Lbs/Method 5100	1200 x 1200
6.	Cold Resistance at -40oF/Method 5874	Pass
7.	Adhesive Lbs. per 1" strip/Method 5950	20

- F. Foam: Density; 1.80+ .05# Cu/Ft; Indentation load deflection (ILD); 40-46#; Tensile 12.0 P.S.I. minimum; Tear 1.50 lbs/inch; Elongation 150% (breaking point); Recovery; 92-93% (compressed 90% and held 22 hours at 1580F); no brittleness; Military Spec T-713A (Mildew and fungus resistant); ASTN Spec C-177-45 (Insulation Factor); ether urethane foam; high resistance to common solvents. Flexible at -400F.
- G. Wood Frame: S/P/F Select Structural, grade #1 only, grading rules for Western Lumber, July 1st, 1974. Western Wood Products Association 3rd edition, Board of Review, American Lumber Standards; Framework, Dimensional lumber, pressure treated with water borne preservatives to comply with AWPBL-2, kiln dried before and after treating. (KDAT)
- H. Guide Stripe: 6" wide; 22 oz vinyl coated nylon; safety yellow; top coated with urethane; shall be sewn at the lower portion of each side curtain.
- I. Fiberglass: Type 160, Class 3 fire retardant, slow burning, flame spread 76-225, F-32 acrylated polyester resin with 25% fiberglass reinforcing matter and further with nylon reinforcing every inch, 6 oz per square foot, thickness .045, Federal and Military Spec L-P-505 BGSA-FSS, T2-70 Fire Retardancy.
- J. Scotchply Stays: Flexible stays - 3M "ScotchplyTM" structural grade thermostat molded material, epoxy impregnated continuous glass filaments in parallel alignment, greater strength, fatigue lift, memory, corrosion resistant and temperature resistant.
- K. Screws/Washers: #10 x 1" Long Philips Pan Head Sheet Metal Screw, Zinc Plated. Each screw to include a #10 x 5/8" Neo-Bond, Self Sealing, Steel Back, Zinc Plated washer.
- L. Thread: GB-207 Polyester (white); 3-Ply Cord; 2.150 yard.ln.; 4.334 Density, M/KGM; 34# breaking strength (15.42 KG) .0170" Diameter; Government Spec #VT285B, Size 3, Type II, Class I, Subclass A.
- M. Color: Provide colors as selected by the Architect from the manufacturer's standard colors.

- N. Owner reserves the right to randomly select dock seal and shelter components to enable laboratory testing, at the manufacturer's expense, to determine that all property values meet or exceed those represented.

2.6 DOCK SEALS

- A. General: Provide the manufacturer's standard dock seals consisting of fabric covered foam pads designed to compress under pressure of the truck body to form an air tight seal at the jambs and head of the loading dock openings. Provide seals with a 10 year life expectancy.
- B. Size of Jamb Pads: Unless otherwise indicated provide beveled profile jamb pads having the following minimum dimensions: 10" wide at the rear wood frame and 19" wide at the face x 10" projection x 9'-2" long at the rear and having a miter at the top to accommodate the beveled head pad and a 3" miter at the bottom. The jamb pads shall mount 3" offset from each side of the opening's width to yield an 8'-0" inside dimension between the face of the pads.
- C. Size and Type of Head Pad: Unless otherwise indicated shall be stationary type and be a beveled profile head pad having the following minimum dimensions: 12" high at the rear wood frame and 16" high at the face x 10" projection x 11'-2" long.
- D. Construction: Provide the manufacturer's standard construction consisting of:
1. A base cover fabric with multiply fabric reinforcing, to wrap behind wood frames and be secured for weathertight construction.
 2. A polyurethane foam core chemically bonded to the wood supporting frame.
 3. Cover fabric, pleats and reinforcing fabric mechanically stitched together having 5 to 5 1/2 stitches per inch, all independently locked with proper tension with beginning and ending of all continuous stitch runs having a minimum of 6 stitches of back tacking.
- E. Base Cover Fabric: Provide vinyl, hypalon, dynalon, flexilons, or polyurethane-coated nylon or polyester fabric with a total minimum weight of 25 oz. per sq. yd. having the following minimum property values in compliance with federal testing standard 191:

	TEST METHOD	RESULTS
1.	Tear Strength Per Lbs/Method 5134	165 x 165
2.	Abrasion Resistance Cycles/Method 5306	1250
	a) H-22 Wheel, 1000 Gram Load, End Point - First Exposure to Base Fabric	
3.	Tensile Strength Per Lbs/Method 5100	550 x 575
4.	Cold Resistance at -40oF/Method 5874	Pass
5.	Adhesive Lbs. per 1" strip/Method 5950	10

- F. Pleated Protectors: Provide protectors on the entire length of each jamb pad and at each end of the head pad in the form of overlapping layers of coated fabric attached to the base cover fabric with each overlapping pleat having 8" of exposure. Pleated protectors shall be of a two-ply construction with each pleat having a total minimum weight of 90 oz. Per sq. yd consisting of two layers of a vinyl, hypalon or polyurethane-coated nylon or polyester with a total minimum weight of 45 oz. per sq. yd. having the following minimum property values in compliance with federal testing standard 191:

	TEST METHOD	RESULTS
1.	Tear Strength Per Lbs/Method 5134	300 x 300
2.	Abrasion Resistance Cycles/Method 5306	6000
	a. H-22 Wheel, 1000 Gram Load, End Point - First Exposure to Base Fabric	
3.	Tensile Strength Per Lbs/Method 5100	1200 x 1200
4.	Cold Resistance at -40oF/Method 5874	Pass
5.	Adhesion Lbs. per 1" Strip/Method 5950	20

- G. Fabric Reinforcing: The entire face and underside of the head pad shall be reinforced with a continuous additional layer of coated fabric. The inside portion of each jamb pad that is exposed to the opening's width shall be reinforced with an additional layer of coated fabric 60" high. Reinforcing fabric shall be of a vinyl, hypalon or polyurethane-coated nylon or polyester with a total minimum weight of 45 oz. per sq. yd. and shall have the following minimum property values in compliance with federal testing standard 191:

	TEST METHOD	RESULTS
1.	Tear Strength Per Lbs/Method 5134	300 x 300
2.	Abrasion Resistance Cycles/Method 5306	6000
a.	H-22 Wheel, 1000 Gram Load, End Point - First Exposure to Base Fabric	
3.	Tensile Strength Per Lbs/Method 5100	1200 x 1200
4.	Cold Resistance at -40°F/Method 5874	Pass
5.	Adhesion Lbs. per 1" Strip/Method 5950	20

- H. Foam: Density: 1.30±.05# Cu/Ft; Indentation load deflection (ILD); soft density 22-26#; Tensile 12.0 P.S.I. minimum; Tear 1.50 lbs/inch; Elongation 150% (breaking point); Recovery: 92-93% (compressed 90% and held 22 hours at 158°F) no brittleness; Military Spec T-713A (Mildew and fungus resistant); ASTN Spec C-177-45 (Insulation Factor).
- I. Wood Supporting Frame: S/P/F Select Structural, grade #1 only, grading rules for Western Lumber, July 1st, 1974. Western Wood Products Association 3rd edition, Board of Review, American Lumber Standards; Framework: Dimensional lumber, pressure treated with water borne preservatives to comply with AWPBL-2, kiln dried before and after treating. (KDAT)
- J. Guide Stripe: 3 1/2" wide; 22 oz vinyl coated nylon; safety yellow; top coated with urethane; shall be sewn full length of each side pad.
- K. Thread: GB-207 Polyester (white); 3-Ply Cord; 2.150 yarn/lb.; 4.334 Density M/KGM; 34# breaking strength (15.42 KG) .0170" Diameter; Government Spec #VT285B, Size 3, Type II, Class I, Subclass A.
- L. Provide pocket for security tap switch sensor sewn in back of Jamb pad at 60" A.F.F. Coordinate size with Lowe's security control contractor.
- M. Color: Provide colors as selected by the Architect from the manufacturer's standard colors.
- N. Owner reserves the right to randomly select dock seal and shelter components, to enable laboratory testing, at the manufacturer's expense to determine that all property values meet or exceed those represented.

2.7 STEEL FACED BUMPERS

- A. Steel-Face, Laminated-Tread Bumpers <Insert drawing designation>: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires and with 3/8-inch (9.5-mm) steel face plate of same size as rubber surface. Laminate plies under pressure on not less than two 3/4-inch (19-mm-) diameter, steel supporting rods that are welded at one end to 1/4-inch- (6-mm-) thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch (25 mm) of tread plies extending beyond the face of closure angles. Weld face plate to two steel support brackets, which shall extend back to and engage 3/4-inch- (19-mm-) diameter support rods in elongated holes, allowing steel face to float on impact.
1. Thickness: 6 inches (152 mm).
 2. Vertical Style: 8 inches (203 mm) wide by 24 inches (610 mm) high

2.8 ALLIED LEVELER PAN UNIT (if indicated on drawings)

- A. 3"X3"X1/4" curb angles provide reliable strength at the edge of the pan
- B. Electrical cut outs for powered docks are included in the pan design
- C. Unit is secured to a floorslab, back filled and poured into the finished floor
- D. All concrete studs are in place for strong interlacing with the concrete pre-slab
- E. Unit is pre-finished in machinery grey
- F. Pan kit is standard dock pit size allowing levelers to be easily removed and replaced

- 1. Comes in all standard sizes 6'X6', 6.5'X6', 7'x6' 6'X8', 6.5'X 8', 7'X8'

2.9 DOOR TRACK GUARDS

- A. Chamfered edge reduces risk of hand injury when lowering door
- B. Wrap-around track design allows for free door operation
- C. Projects 7" from wall
- D. Anchors to both wall and floor
- E. Columns are 3/16" thick steel
- F. Base plate is 3/8" thick steel with three 5/8" holes (fasteners not included)

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Examine rough-in for electrical systems for dock equipment to verify actual locations of connections before installation.
- B. Examine walls and floors of pits for suitable conditions where recessed dock equipment is to be installed. Pits shall be plumb and square, and properly sloped for drainage from back to front of dock.
- C. Electrical Connections: Rough-in electrical connections according to requirements in Division 16.
- D. Dock Levelers: Set curb angles in concrete with tops flush with platform. Fit exposed connections together to form hairline joints. Attach leveler securely to loading platform construction, flush with adjacent dock surfaces and square to recessed pit.
 - 1. Edge-of-Dock Levelers: Attach levelers to structure in a manner that complies with requirements indicated for arrangement and position relative to top of platform.
 - a. Weld anchor holes in contact with continuous embedded dock edge channel. Weld or bolt bumper blocks to dock face.
 - 2. Dock Levelers:
 - a. General Contractor to provide curb angle for installation in work.
 - b. Pit Design to 20" pit depth for new construction. Sloped pit to facilitate easy pit clean out of debris and water.
 - c. Install in sloped pit in accordance with manufacturer's installation instructions.
 - d. Set square and level. Anchor securely flush to dock floor, shim where applicable to keep flush, weld back and front of sub-frame to curb angles.
 - e. Adjust installed unit for operation as specified by manufacturer.
- E. Dock Shelters: Attach dock shelter securely to building structure in proper relation to openings, dock bumpers, and dock levelers to ensure an effective seal of dock-shelter curtains with sides and top of truck body when trucks are positioned against dock bumpers.
- F. Test dock levelers and lifts for vertical travel within operating range indicated.
- G. GC to install folding dock gate to one side of the door jamb as required by manufacturer and install in operating order as specified by manufacturer

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain loading dock equipment.

3.3 WARRANTY

- A. Edge of Dock Leveler and Dock Shelter Warranty: Manufacturer's standard form in which manufacturer agrees to repair dock leveler components that fail in materials or workmanship within one year from date of Final Acceptance by Owner.
 - 1. Warranty shall be for unlimited usage of leveler for specified rated capacity over term of warranty.
- B. Dock Leveler Warranty: Manufacturer agrees to warranty Lifting System for five years from date of Final Acceptance by Owner on parts and labor, and include all fittings, seals, motors, air bag. All lifting system components to be free from defects in material and workmanship for a period of five years from date of Final Acceptance by Owner. Lip Hinge to carry a lifetime warranty parts and labor warranty on Air Powered units. Dock leveler structure (deck section, lip section, rear hinge, front hinge and sub-frame) to carry a 10 year warranty from date of final acceptance by Owner.

END OF SECTION 11160

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SECTION 13916 - FIRE-SUPPRESSION SPRINKLERS**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 fire-suppression sprinklers, piping, equipment and related items:
 - 1. Wet-pipe, fire-suppression sprinklers, including piping, valves, specialties, and automatic sprinklers.
 - 2. Portable fire extinguishers.
 - 3. Hose valves.

1.03 DEFINITIONS

- A. Provide: Furnish and install.
- B. Working Plans: Documents, including shop drawings, calculations, and material specifications prepared according to the NFPA Standards referenced in Section 1.08, Quality Assurance for obtaining approval from AHJ, Lowe's and Fire Protection Consultant.
- B. AFF – Above finished floor
- C. ELO – Extra large orifice
- D. ESFR – Early suppression fast response
- E. AHJ – Authority or authorities having jurisdictions
- F. FM – Factory Mutual
- G. NEMA – National Electrical Manufacturers Association
- H. NFPA – National Fire Protection Association
- I. NICET – National Institute for Certification in Engineering Technologies
- J. OS&Y – Outside screw and yoke (valve)
- K. QR – Quick response
- L. UL – Underwriters Laboratories

1.04 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design sprinkler systems according to the criteria and hydraulic design densities set forth herein and as shown on the drawings and obtain approval from AHJ, as follows: City of Little Rock, AR

- B. Design sprinkler piping according to the following:
 - 1. Include minimum 5 psi margin of safety for available water flow and pressure or higher, if required by the AHJ.
 - 2. Include losses through water-service piping, valves, and backflow preventers.
 - 3. Minimum Density and Maximum Protection Area: in accordance with NFPA 13 or as limited by the sprinkler approval listing.
 - 4. Include seismic protection in conformance with NFPA 13 requirements, per Section 3.06F.
 - C. Components and Installation:
 - 1. Capable of producing piping systems with 175-psig minimum working-pressure rating, unless otherwise indicated.
 - 2. Fire protection products shall be installed in accordance with their UL listing and the manufacturer's requirements.
- 1.05 DESIGN CRITERIA
- A. Use the design criteria herein unless more stringent requirements are dictated by AHJ. Notify Lowe's project manager and Fire Protection Consultant if that occurs.
 - B. Use the waterflow test data shown on the FP drawings unless it will be more than one year old on the date that the installation proceeds. In that case, use that data only for bidding purposes and carry out a new waterflow test after award of contract—see 3.01.
 - C. If necessary due to required piping changes, prepare complete hydraulic calculations to verify final pipe sizing, in accordance with the requirements of NFPA 13. Verify correct schedule of pipe in hydraulic calculations.
 - D. The design criteria set forth in E below were used for this project. Use the same criteria if changes are necessary, unless modified by AHJ.
 - E. Comply with NFPA 13, as referenced in Section 1.07, Quality Assurance, as follows:
 - 1. Office Area and Restrooms: Light Hazard
 - 2. Warehouse: Match existing protection criteria.
 - F. For the office area and restrooms, use 0.10 gpm/sq.ft. over 1,500 sq.ft. Limit sprinklers to 225 sq.ft. maximum spacing. For lay-in ceilings: Use Tyco UL Listed and/or FM Approved, quick response, ½ inch orifice, nominal K=5.6, ordinary temperature rated, semi-recessed, chrome pendent sprinklers, with chrome escutcheons, except intermediate temperature rated sprinklers in electrical rooms. UL listed and FM approved flexible connector drops, complete with brackets for connection to ceiling grid, manufactured by Flex-Head Industries, Inc. can be utilized between the sprinkler branch line and the pendent sprinkler in office areas in lieu of steel pipe and fittings. (1,950 sq.ft. for dry system portions).
 - G. Refer to the FP drawings for applicable areas.
- 1.06 SUBMITTALS
- A. The fire sprinkler contractor shall add their title block and submit working plans (drawings, hydraulic calculations and product data sheets) to the AHJ in accordance with NFPA 13 within 10 working days after the General Contractor has been awarded the contract. Submit revised working plans, if required, within 7 days after receipt of comments.
 - B. The fire sprinkler contractor shall submit together (partial submittals not allowed) within 21 days from the date of the award of subcontract, detailed shop drawings and all other information (including: material data sheets and hydraulic calculations, even if not changed) to the general contractor, all in PDF format.
 - C. The fire sprinkler contractor shall upload or have uploaded to SiteFolio (partial submittals not allowed) within 21 days from the date of the award of subcontract, detailed shop drawings and all other information (including: material data sheets and hydraulic calculations, even if not changed), in PDF format.
 - D. One complete approved submittal shall be maintained on site for the duration of the project. This set of drawings shall be used to track any field changes that may occur. The tracked changes shall then be incorporated into a complete set of "As-Built" drawings that shall be submitted at the close of the project.
 - E. Product Date: For the following:
 - 1. Pipe and fitting materials and methods of joining for sprinkler piping, including welded outlets.
 - 2. Pipe hangers and supports.
 - 3. Piping seismic restraints.
 - 4. Valves, including specialty valves, accessories, and devices.

5. Alarm and dry-pipe valves and accessories.
 6. Alarm devices. Include electrical data.
 7. Air compressors. Include electrical data.
 8. Fire department connections. Include type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
 9. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
 10. Backflow devices and accessories (include head losses)
 11. Hose connections
 12. Fire extinguishers
 13. Hydraulic data and sprinkler system identification signs
 14. Spare sprinkler cabinets
 15. Pressure gauges, drain and trim valves and inspector's test connections
 16. Fire stop materials
- F. Sprinkler Working Drawings and Hydraulic Calculations: Expand from Fire Protection Consultant prepared material to include all required information, as follows:
1. Include all information required for working drawings by NFPA 13 as applicable to this project.
 2. Include a site plan with information relevant to this project, as follows:
 - a. Property lines, names of adjacent streets or roads, and existing utilities.
 - b. Building location, valve pit location (if applicable), and hydrant locations.
 - c. Indicate point of compass.
 - d. Size of city main in street, pressure and whether dead-end or circulating and, if dead-end, direction of the flow, and flow test results.
 - e. Indicate location and distance to hydrants used for flow test, giving elevation of hydrants in relation to proposed floor elevation of building.
 - f. Show date and time of day of flow test and by whom it was conducted.
 - g. Indicate the effective point of the water flow test. This shall be the beginning point of all calculations.
 - h. Underground pipe, stating size, material, length, depth below finished grade, and point of attachment to city main.
 - i. Valve pit schematic, showing arrangement of components and stating manufacturer's name and model number of each.
 3. Include plans showing pipe layout and sprinkler locations, as follows:
 - a. Show two full-height sections: one through the front canopy, office area and sales area and one through the sales area and Garden Center. Refer to the 'FP' Sheets for applicable areas.
 - b. Indicate the nominal size of pipe, cutting lengths and elevations.
 - c. Indicate the location of all control valves, check valves, drain points, and test connections.
 - d. Indicate the total area protected by each system, total number of sprinklers per system, and the capacity in gallons per dry system.
 - e. Show location and size of riser nipples, types and locations of hangers, seismic bracing (when applicable) and sleeves. Indicate center-to-center dimensions between sprinklers and between branch lines, as well as dimensions between sprinklers and adjoining structural members.
 - f. In schedule form, identify each component of the sprinkler system, including type, diameter and wall thickness of all pipes, manufacturer's name and model number for all valves and controls, and manufacturer's name, model number, temperature rating, and orifice size of all sprinklers. Refer to Part 2 for permitted components.
 - g. In a detailed schematic of the sprinkler riser, identify all component parts and accessories.
 - h. Show flushing connections in cross mains and grid line piping as specified in NFPA 13.
 - i. Include water supply information and the text for the hydraulic design information sign, as provided by NFPA 13.
 - j. Show location, size, and type of portable fire extinguishers on sprinkler shop drawings.
 4. Base the design on actual field survey and all of the latest general construction, structural, heating and air conditioning, plumbing, and electrical drawings.

- G. Field Test Reports and Certificates: Obtain "Contractor's Material and Test Certificate for Underground Piping" from the building general contractor. Submit, together with "Contractor's Material and Test Certificate for Aboveground Piping," to Lowe's Construction Manager and Fire Protection Consultant. Refer to Division 1 Section 01770 "Closeout Procedures".
 - H. Maintenance Instructions: Submit two copies of bound sets of printed operating and maintenance instructions, as described in Division 1 Section 01770 "Closeout Procedures". Include two copies of the latest edition of NFPA 25.
 - I. As-Built Drawings: One (1) white bond paper copy and one (1) 'CD' electronic format (AutoCAD 2010) of the sprinkler system "As-Built" shop drawings, two (2) copies of the hydraulic calculations and two (2) copies of the manufacturer's descriptive literature as specified in Section 13916, are distributed as follows:
 - 1. One (1) white bond paper copy of the sprinkler system "As-Built" Shop drawings, hydraulic calculations, and manufacturer's descriptive literature shall be included in the "Project Close-out Documents" set designated as the Store's copy.
 - 2. One (1) 'CD' electronic format (AutoCAD 2010) of the sprinkler system "As-Built" shop drawings, hydraulic calculations, and manufacturer's literature shall be included in the "Project Close-out Documents" set designated as the Lowe's copy.
- 1.07 QUALITY ASSURANCE
- A. Installer Qualifications: An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from AHJ.
 - B. Engineering Responsibility: Preparation of working plans and calculations by a qualified professional engineer or NICET Level 3 or 4 qualified person as required by AHJ.
 - C. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" or FM's "Approval Guide" and that comply with other requirements indicated.
 - D. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to AHJ.
 - E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to AHJ.
 - F. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:
 - 1. NFPA 10, "Portable Fire Extinguishers," current edition.
 - 2. NFPA 13, "Installation of Sprinkler Systems," current edition, or an earlier edition as required by AHJ.
 - G. Local Codes

PART 2 - PRODUCTS

2.01 MAIN RISER COMPONENTS

- A. Wet System Riser:
 - 1. Gear operated indicating type butterfly valve, with internal valve supervisory switch, grooved ends, UL listed and FM approved, Kennedy Model G300, (21/2"- 6") and Model 01G (8"only, UL Approved), Tyco Model BFV-N, Victaulic FireLock Series 705 or Nibco Model GD-4765-8N (2½"-8").
 - 2. Complete riser assembly: Viking Easy Riser Check Valve Model F-1 (3"-8") with trim set, Central Model CV-1FR Riser Check Valve (2½"-6") and trim, Reliable Model G Right-Check Riser Valve (2½"-6") with trim kit, or Victaulic Series 717R FireLock Check Valve (4"-8") with trim kit.
 - 3. Grooved end check valve with separate main drain assembly, two (2) pressure gauges and single waterflow alarm switch, Tyco Model CV-1F, Nibco Model G-917-W or United Brass Model 67.
 - 4. Include main drain assembly, waterflow alarm device, pressure gauge, and other required appurtenances.

2.02 SPRINKLERS

A. Acceptable Manufacturers

1. Acceptable Fire Sprinkler Manufacturer:

a. Johnson Controls

Primary Contact: Melisa Rodriguez-- Phone:612-213-7982; Email:
melisa.rodriguez@jci.com

2. Approved Manufacturer: All General Contractors bidding or negotiating a Lowe's project shall have their Approved Fire Protection Sub Contractor contact Johnson Controls, Jack Frye (at above number) to obtain Lowe's pricing for Approved Sprinklers. This pricing shall be included in the General Contractor's bid for Fire Protection Sprinkler installation.

B. Provide only new Tyco sprinklers of current model and manufacture date. Do not provide any sprinkler included in a recall program. Do not provide any sprinkler with an O-ring seal.

C. Reference Section 1.06, Design Criteria, for specific sprinkler types and model numbers, to be utilized in the various areas of the store.

2.03 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.04 PIPES

A. In accordance with NFPA 13 requirements and 3.02, Piping Applications.

2.05 PIPE FITTINGS

A. In accordance with NFPA 13 requirements and 3.02, Piping Applications.

2.06 JOINING MATERIALS

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for pipe-flange gasket materials and welding filler metals.

2.07 GENERAL-DUTY VALVES

A. Refer to Division 15 Section "Valves" for gate, ball, butterfly, globe, and check valves not required to be UL listed or FM approved.

2.08 FIRE-PROTECTION-SERVICE VALVES

A. General: Refer to 2.01 for specific requirements.

B. General: UL listed or FM approved, with minimum 175-psig nonshock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.

C. Gate Valves, 2-inch and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and rising stem.

D. Indicating Valves, 2-1/2-inch and smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device.

1. Indicator: Visual.

2. Indicator: Electrical 115-V ac, prewired, two-circuit, supervisory switch.

E. Butterfly Valves, 2-1/2-inch and larger: UL listed and FM approved, gear operated, indicating type, grooved end butterfly valves, with internal valve supervisory switch. Approved manufacturers, Kennedy, NIBCO, Tyco and Victaulic.

F. Indicator-Post, Gate Valves: UL 262, iron body, bronze mounted, solid-wedge disc, and nonrising stem with operating nut and flanged ends.

G. Indicator Posts: UL 789, horizontal, wall type, cast-iron body, with windows for target plates that indicate valve position, extension rod and coupling, locking device, handwheel operation, red enamel finish.

H. Swing Check Valves, 2-inch and smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.

I. Swing Check Valves, 2-1/2-inch and larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and grooved ends.

J. Grooved Check Valves, 4-inch and larger: UL 312, cast-iron body with rubber seal, bronze-alloy discs, and stainless-steel spring and hinge pin.

2.09 SPECIALTY VALVES

- A. General: Refer to 2.01 for specific requirements.
- B. Ball Drip Valves: UL 1726, automatic drain valve, 3/4-inch, ball check device with threaded ends
- C. Automatic Air Release Valve: UL 2573, manual ball valve with a minimum size of 1/2 inch.

2.10 ALARM DEVICES

- A. General: Refer to 2.01 for specific requirements.
- B. Waterflow Alarm: UL 346; electrical-supervision, vane-type waterflow detector; with 250-psig pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 amp, 125-V ac and 0.25 amp, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed. Acceptable manufacturers: Tyco Model VSR (2"-8"), Potter Electric Signal Model VSR (2"-10") or Viking Model VSR (2"-10").
- C. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally open contacts. Include design that signals controlled valve is in other than fully open position. Acceptable manufacturers: Tyco-Gem Model OSYSU-2 or Potter Electric Signal Model OSYSU-2, or Tyco-Gem Model PCVS-2 or Potter Electric Signal Model PCVS-2, as applicable.
- D. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw, with normally open contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

2.11 PRESSURE GAUGES

- A. Pressure Gauges: UL 393, 3 1/2 to 4 1/2-inch diameter dial with dial range of 0 to 250 psig.

2.12 ACCESSORIES

- A. Metal signs: Provide and install identification signage as required by NFPA 13 for such items as FDC, alarms, hydraulically designed systems, pipe, sprinklers and valves.

2.13 PORTABLE FIRE EXTINGUISHERS

- A. Listed and labeled ANSI/UL approved.
- B. Water type: 2 1/2-gallon, stored pressure, rechargeable, 2A classification, with clip for wall or rack mounting.
- C. Multipurpose: dry chemical (ammonium phosphate), stored pressure, rechargeable, 10 lbs 4A:60B:C classification, with clip for wall or rack mounting, for low-temperature applications when mounted in unheated spaces. Approved manufactures are: Ansul, Badger, Amerex and Buckeye.
- D. Instruction manual: owner's instructions for installation, use and maintenance, following NFPA 10 guidelines.
- E. Signage: "Fire Extinguisher" placard for each extinguisher, as directed by AHJ.

PART 3 - EXECUTION**3.01 PREPARATION**

- A. Immediately after award of contract, obtain an electronic file of the fire protection design drawings and a copy of the project's sprinkler system hydraulic calculations. Use these for preparing the working drawings and final calculations (if necessary). When rack revisions occur, the sprinkler contractor shall obtain a revised electronic file of the revised fire protection drawings and hydraulic calculations from Fire Protection Consultant, with no additional cost to contract. Contact the Fire Protection Consultant representative listed in 1.07C.
- B. Make no changes in installation from the layout shown on the "FP" sheets, unless change is specifically approved by Fire Protection Consultant. This does not include minor revisions for the purpose of coordination.
- C. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291 if required by 1.06B. Contact Fire Protection Consultant for required test procedures before performing the test. Submit the new data to Fire Protection Consultant, Lowe's Engineering Dept. and Lowe's Construction Manager for approval before proceeding with the design. Report test results promptly and in writing.
- D. Obtain all necessary state, county, municipal and water utility approvals and permits and pay all fees, taxes and other costs associated with the installation.

- E. Report any discrepancy between the FP drawings and these specifications to Lowe's Construction Manager. Obtain immediate clarification on any item pertaining to this project from Lowe's Construction Manager.

3.02 PIPING APPLICATIONS

- A. Use pipe sizes 8-inch or smaller for interior applications, except 10-inch is permitted in the sprinkler room.
- B. Support piping to assure that no point loads (calculated weight of water-filled pipe) to joists exceeds 250 pounds and that any point loads in excess of 100 pounds occur within 6 inches of a joist panel point. If any point loads in excess of 100 pounds occur beyond 6 inches of a joist panel point, provide angle bracing as shown on the FP drawings ("Typical Pipe Supporting Detail" on FP drawings).
- C. Use only black steel pipe, Schedule 10 or heavier for interior applications. Do not use threaded thinwall or lightwall piping. Use Schedule 10 piping in sizes larger than 2-inch. Schedule 40 threaded galvanized steel pipe and fittings or Schedule 10 galvanized piping with galvanized welded outlets, grooved couplings and fittings or Gal-5 galvanized sprinkler pipe, 2 inch and smaller, by IDOD, shall be installed in the Shade Structure. Installation of galvanized piping shall begin on the sales area side of the wall separating sales area from shade structure. All Shade Structure piping, fittings and hangers, including hanger rod and fastener components, welded outlets, grooved couplings and fittings shall be galvanized. Welding of galvanized piping generates poisonous fumes. All shop welding shall be done in accordance with applicable standards and in a manner that does not expose anyone to health endangering conditions. Any damage to the galvanized coating that occurs from welding, grooving the pipe ends, field installation, inadequate initial treatment, or any other case shall be repaired in a workmanship like manner prior to the acceptance of the sprinkler system installation by Lowe's.
- D. Do not use mechanical tees (not permitted by Lowe's). Do not use plain-end fittings, plain-end couplings or clamp fittings. Use only welded outlets or screwed fittings at sprinklers. For all other applications, use roll-grooved, threaded, welded or flanged connections; using UL listed or FM approved fittings and couplings.
- E. With threaded fittings or cut-groove fittings and couplings, use not less than Schedule 40 thickness pipe up to and including 8-inch pipe. Use minimum Schedule 10 pipe for roll-grooved pipe and fittings or welded fittings in sizes up to and including 5-inch, with wall thickness of 0.134 inch for 6-inch pipe and 0.188 inch for 8-inch pipe.
- F. In the Office Area, Schedule 10 or Schedule 40 piping shall be used. In the Warehouse, Schedule 10 piping shall be used. The schedule of piping installed shall match the hydraulic calculations that are submitted to and approved by the AHJ.
- G. Flanges, unions, transitions and special fittings with pressure ratings the same as or higher than system pressure rating may be used in aboveground applications, unless otherwise indicated.
- H. Firestopping: Use approved materials for firestopping when penetrating fire-rated walls, as required by the applicable building code. Refer to Architectural drawings for locations of fire-rated walls. Refer to FP drawings for firestopping details.

3.03 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Fire-Protection-Service Valves: UL listed or FM approved for applications where required by NFPA 13. Use grooved end butterfly valves for shutoff duty.
- B. General-Duty Valves: For applications where UL-listed or FM-approved valves are not required by NFPA 13.
 - 1. Shutoff Duty: Use gate, ball, or butterfly valves.
 - 2. Throttling Duty: Use globe, ball, or butterfly valves.

3.04 JOINT CONSTRUCTION

- A. Refer to NFPA 13 and Section 15050 "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.05 PIPING INSTALLATION, GENERAL

- A. Refer to Section 15050 "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from AHJ. File written approval with Lowe's Construction Manager before deviating from approved working plans.
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- E. Hangers and Supports:
 - 1. Comply with NFPA 13 for hanger materials and installation.
 - 2. Refer to 3.02B, 3.02C and 3.07G, H and I for special hanger and support requirements applicable to all Lowe's locations.
 - 3. Sprinkler piping hangers shall not be hung from or attached directly to the roof decking. No holes shall be made in the roof deck for hanger support. No drilling of holes in the shade structure support members for hanger support will be allowed. All ceiling level sprinklers shall be supported from the top chord of the roof structural steel members.
- F. Earthquake Protection: Rigid seismic protection shall be provided in conformance with NFPA 13 requirements when seismic protection is indicated on the sprinkler design drawings. Seismic protection shall also be provided as required by the AHJ. Cable and/or wire type bracing systems shall not be considered an approved method of bracing for Lowe's fire protection systems.
- G. Pressure Gauges: Install pressure gauges on riser or feed main. Include soft metal-seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they will not be subject to freezing.
- H. Escutcheons: Provide chrome-plated escutcheon plates, appropriately sized, at all wall and ceiling penetrations.
- I. Patching and Repairs: Patch or repair surfaces damaged as a result of the installation of the sprinkler system. Repair galvanizing and other protective coatings on pipe and fittings, damaged during fabrication or installation.

3.06 SPRINKLER PIPING INSTALLATION

- A. General: Install sprinklers throughout the building. Follow NFPA 13 requirements and any additional requirements of AHJ.
- B. Install all piping in a neat and workmanlike manner, with all pipe hung true to line and grade.
- C. Correct sizing of piping and accessories is the responsibility of the sprinkler subcontractor; however, do not use sizes smaller than shown on plans.
- D. The sprinkler contractor shall be responsible for coordinating the elevation of all sprinkler mains, crossmains, and branchlines with other trades (electrical, mechanical, structural, etc) in all areas of the building. Piping shall be installed a minimum of 20 feet AFF and shall not be installed under the bottom of the joist girder under any circumstances. (Lowes requires all sprinkler pipe to be installed above the bottom of the joist girders and also requires a minimum clear height of at least 20 feet AFF.) Locate auxiliary drains and inspector's test connections tight against the perimeter walls. Refer to "Typical Low-Point Drain Detail" on the FP drawings.
- E. Maintain a 20-foot clear, unobstructed height throughout the sales, storage and receiving areas. If this height cannot be maintained at any point, coordinate with Lowe's Construction Manager for acceptable installations.
- F. Use 8-inch maximum pipe size for piping supported from the roof framing.
- G. For 6-inch mains running parallel to the joists, provide a hanger at each joist girder/beam and provide a hanger not over 8 feet on-center between joist girders/beams. For 8-inch mains running parallel to the joists, center pipe between adjacent joists and use trapeze hangers spaced not over 8 feet on-center.
- H. For pipe running perpendicular to the joists, provide a hanger at each joist for 6- and 8-inch pipe.
- I. Install pipe larger than 3-inch running perpendicular to bar joists within 6 inches of a top angled panel point or provide additional bar joist bracing.

- J. Coordinate ESFR sprinkler locations with other trades to avoid obstructions that restrict their discharge, such as lighting, bar joists, joist strapping, cross bridging, girders, roof top units (RTUs), cable trays, conduit banks, roof downspouts, etc. Make every effort possible to avoid these obstructions. Avoid sprinklers under skylights. Contact Lowe's Construction Manager if questions arise.
 - K. Keep ESFR sprinklers at least 1'-0" away from the edge of all structural steel members, including bridging and bracing, in accordance with NFPA 13.
 - L. Provide grid-system relief valve on each gridded wet-pipe system as required by NFPA 13.
 - M. Pitch dry-system piping towards drain as required by NFPA 13 and as follows: a minimum slope of 0.03 and 0.05 inches per foot must be maintained on mains and branch lines respectively. Dry-system piping shall be checked with an electronic magnetic level such as (Stabila Model Number 38924 Type 196-EM 24-Inch) during installation to ensure proper pitch towards drain. Dry pipe systems shall not be gridded. Only utilize eccentric reducers on dry pipe systems.
 - N. Provide inspectors test connections and low-point drains in accordance with NFPA 13 and as indicated on the FP drawings. Each individual Inspector's Test Connection/Low Point Drain shall be provided with a sign to indicate that piping is Inspector's Test Connection and/or Low Point Drain. Sign shall also indicate sprinkler system zone number. Include locations on the working drawings. Mount control valves 5 feet A.F.F. and locate low-point drains inside the building. Pipe drain lines to the exterior of the building, in accordance with the Typical Low-Point Drain Detail on the FP drawings. Coordinate with the Lowe's Construction Manager for acceptable locations.
 - O. Provide sprinklers in the electrical room and telephone room as indicated. Do not install any sprinkler piping anywhere in these rooms from floor to ceiling except the branch lines supplying the sprinklers in these rooms. Route all other sprinkler piping, including auxiliary drains and test connections, around these two rooms.
 - P. Provide in-rack sprinklers as required by 1.06, Design Criteria, and as shown on the FP drawings.
 - Q. Provide for 60-second maximum time period for water discharge from inspectors test connection of each dry-pipe system when tested in accordance with NFPA 13.
 - R. The in-rack sprinkler piping installations shall be completed 24 hours prior to stocking of the paint department and carpet racks. Any overtime work required to complete the installation shall be included in the base bid.
- 3.07 SMALL HOSE CONNECTIONS
- A. When fire hose connections are shown on the FP drawings, provide 1½-inch or 2½-inch hose valves as indicated, (with 1½-inch reducer for 2½-inch connections), cap and chain, in accordance with NFPA 13 or 231C. Mount 4 to 5 feet above the floor or as otherwise directed by AHJ. Each individual fire hose valve shall be provided with a sign indicating the sprinkler system/zone number it is supplied from. For bidding purposes, use the locations shown on the FP drawings. Request an updated rack layout from Lowe's Construction Manager prior to installing hose connections and revise locations as required. Verify with Lowe's Store Set-Up Project Manager that the new rack layout matches his shop drawings and make such changes as required. Contact Lowe's Construction Manager if questions arise.
- 3.08 SPECIALTY SPRINKLER FITTING INSTALLATION
- A. Install specialty sprinkler fittings according to manufacturer's written instructions.
- 3.09 ELECTRICAL EQUIPMENT AND DEVICES
- A. Install waterflow, pressure and valve supervisory switches. Coordinate with Lowe's Construction Manager for latest permitted date of installation. Wiring by fire alarm subcontractor.
- 3.10 VALVE INSTALLATION
- A. Refer to Section 15110 "Valves" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13, manufacturer's written instructions, and AHJ.
 - B. Gate Valves, Butterfly Valves and Post Indicator Valves: Install fire-protection-service valves supervised-open and monitored by the fire alarm system, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
 - C. Automatic Air Release Valve: Provide an automatic air release valve at an accessible location on the highest point of each wet-pipe sprinkler system.

3.11 SPRINKLER APPLICATIONS

- A. General: Use sprinklers as set forth in 2.02, Sprinklers.

3.12 SPRINKLER INSTALLATION

- A. General: Install sprinklers in accordance with 1.06, Design Criteria, and NFPA 13.

3.13 CONNECTIONS

- A. Connect piping to specialty valves, specialties, fire department connections, and accessories.

3.14 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and as required by AHJ.
- B. In states where applicable, in accordance with state and/or local code requirements, the sprinkler contractor shall be responsible for providing and displaying proper inspection tags for the sprinkler system installation.

3.15 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping as provided by NFPA 13. Provide advance notification of date and time of tests to permit witnessing of tests by Lowe's and AHJ. Properly dispose of water used in flushing and testing.
- B. Limit leakage in accordance with NFPA 13 requirements. Repair or replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Do not use additives, corrosive chemicals (sodium silicate or derivatives thereof), brine, "Stop Leak," or other chemicals while carrying out hydrostatic tests or for stopping leaks.
- D. In addition to the standard hydrostatic test, carry out an air pressure leakage test at 40 psi for 24 hours. Correct loss of pressure in excess of 1½ psi for the 24-hour period.
- E. Test each waterflow alarm device, alarm circuit, dry-pipe valve, electronic dry pipe accelerator and backflow preventer assembly as provided by NFPA 13. Coordinate with the underground subcontractor and the fire alarm subcontractor as required.
- F. Report test results promptly and in writing to Lowe's Construction Manager and AHJ.

3.16 CLEANING

- A. Clean dirt and debris from sprinklers, pipe fittings and valves.
- B. Remove coverings provided for protection during painting.
- C. Remove and replace sprinklers having paint other than factory finish.

3.17 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion. Also refer to Section 3.05A requirements.

3.18 OTHER INSTALLATIONS

- A. Prior to Substantial Completion, install sprinkler cabinet in the sprinkler room where shown.
- B. Install sprinkler system valve, system hydraulic data and other required signage.
- C. Prior to Substantial Completion, install fire extinguishers where shown on the FP drawings and as required by NFPA 10 and AHJ. Mount with top not over 4 feet above the floor. Coordinate exact mounting locations on walls and racks with Lowe's Store Set-Up Project Manager.
- D. Install directional sign at each extinguisher at the time of extinguisher installation as may be required by AHJ.
- E. Deliver maintenance instructions to Lowe's Construction Manager.

3.19 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that air compressors and their accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete.
- D. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- E. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- F. Drain dry-pipe sprinkler piping.
- G. Pressurize and check dry-pipe sprinkler piping air-pressure maintenance devices, electronic dry pipe accelerator and air compressors.
- H. Verify that fire department connections have threads compatible with local fire department equipment.
- I. Fill wet-pipe sprinkler piping *slowly* with water, purge excess-trapped air and verify that all water supply valves (including outside valves) are fully open. The contractor shall leave the auxiliary drain valve open on the remote wet pipe system cross main piping, during the filling process, the help relieve air pockets.
- J. Energize circuits to electrical equipment and devices.
- K. Start and run air compressors.
- L. Adjust operating controls and pressure settings.
- M. Coordinate with fire alarm tests. Operate as required.
- N. Coordinate with fire-pump tests. Operate as required.
- O. Provide lift for 1 (one) day and an operator for 4 (four) hours at both the 90% and 100% construction observations for use by Fire Protection Consultant to verify compliance with sprinkler piping installation requirements. Lift shall be provided with non-marking tires and protection against fluid or other leaks. Coordinate availability with the General Contractor, Lowe's Construction Manager and Fire Protection Consultant.

3.20 DEMONSTRATION

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. Schedule demonstration with Owner with at least seven days advance notice.

3.21 ACCEPTANCE

- A. Final approval and acceptance is granted only after the satisfactory completion of an inspection and a performance test administered by Lowe's Construction Manager, and Fire Protection Consultant.

END OF SECTION 13916

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SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED SECTIONS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK:

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1 and form a part of and shall govern all work performed under these specifications
- B. These specifications, contract documents, and attached drawings are issued as part of this specification. Any requirements shown herein are equally affective as if included in this specification. Omissions in this specification or on the contract documents shall not be a basis for failure on the part of the contractor, from installing all components required for a complete and operable system. Should any system or portion of work called for within these specifications or on the contract documents in such a manner that the Contractor cannot, in his judgment, comply with the requirements, then the Contractor shall bring the matter to the attention of the Engineer prior to proceeding with the work.
- C. The Contract Documents depict the scheduled equipment and components as a basis of design. Should the Contractor submit and receive approval for equipment that is acceptable by specification, but differs from that of the basis of design, the Contractor shall be responsible for coordination of that equipment with all other trades. Costs incurred to provide increased service to or from said piece of equipment or system shall be borne by the Contractor supplying the equipment or system at no additional cost to the Owner.
- D. Work includes the installation of all necessary equipment, piping, ductwork, and components for complete and operable systems.
- E. This project includes the following systems:
 - 1. Direct Expansion Refrigeration System
 - 2. Air Distribution System
 - 3. Domestic Water Distribution Piping
 - 4. Sanitary Waste, Condensate, and Vent System
 - 5. Storm Water System
 - 6. Fuel Gas System
 - 7. Honeywell Opus Platform Building Automation System.

1.3 DEFINITIONS AND TERMS:

- A. The word "Owner" shall be defined as the party mentioned in the prime contract agreement, or any representative of his party authorized to act in his behalf in the execution of the work.
- B. The word "Contractor" shall be defined as the person, firm or corporation entering into a contract with the owner to construct and complete the work as specified herein.
- C. The word "furnish" shall be defined as to supply and deliver to project site, ready for unloading, unpacking, assembly, installation and similar subsequent requirements.

- D. The word "install" shall be defined as operations at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar requirements.
- E. The word "provide" shall be defined as to furnish and install complete, ready for intended use as defined above.

1.4 SUBMITTALS:

- A. General: Each contractor shall submit shop drawings as stated in Division 1 Sections pertaining to submission of shop drawings, product data, samples, and as specified herein.
- B. Approval of shop drawings does not relieve the contractor of the responsibility for ordering proper quantities and miscellaneous appurtenances required for operation and/or installation of the respective material or equipment nor from the responsibility of complying with all elements of the Contract Documents.
- C. Provide specific information with each submittal as stated in the respective specification sections.
- D. The following General Information is required with each submittal as applicable.
 - 1. Full manufacturer's model name and number of each item
 - 2. Equipment performance, physical size by dimension, and construction data.
 - 3. Finishes: Provide two (2) color samples for equipment requiring color/finish selection.
 - 4. Location of connection points for external piping, ductwork, and electrical connections.
 - 5. Rough-in/foundation and support point dimensions.
 - 6. Complete wiring diagrams and connection identifications.
 - 7. Contractor's stamp, signature and date shall be affixed to submittal drawing indicating his review and approval.

1.5 PERMITS AND INSPECTIONS:

- A. The Contractor shall obtain and furnish all necessary permits and inspection certificates for all material and labor furnished by him.
- B. Permits and certificates shall be obtained from the proper inspection authorities. The cost of permits, certificates and all fees required in connection with the installation shall be borne by the Contractor, unless otherwise noted in the detailed contractual description preceding these Mechanical Specifications.
- C. Where applications are required for the procuring of utility services to the building, this Contractor shall see that such application is properly filed with the utility and that all information required for such an application is presented to the extent and in the form required by the utility company.

1.6 DRAWINGS:

- A. The drawings and the specifications are cooperative and supplementary. It is the intent of both said drawings and specifications to cover all mechanical requirements in their entirety as nearly as possible. The Contractor shall closely check the drawings and specifications for any obvious errors or omissions, and bring any such condition to the attention of the Engineer
- B. The Contractor shall have a complete set of drawings including civil, architectural, structural, mechanical and electrical drawings on the site at all times. Prior to installing any of his work, he shall check the drawings for exact dimensions and see that his work does not interfere with clearance required for beams, foundations, finished columns, pilasters, partitions, piping, ductwork, etc., as shown on the drawings and details.

- C. After work is installed and it develops that interferences occur which have not been called to the Engineer's attention before the installation, the Contractor shall, at his own expense, make such changes in his work as directed by the Engineer.
- D. The contract drawings for mechanical work are in part diagrammatic, intended to convey the scope of work and indicate general arrangement of equipment, piping, ductwork, etc., and approximate sizes and locations of equipment and materials.
- E. Where job conditions require reasonable changes in indicated locations and arrangement, the Contractor shall make such changes as directed by the Engineer, without additional cost to the Owner.
- F. Because of the scale of the drawings, certain basic items may not be shown, but where such items are required by other Sections of these specifications or where they are required by the nature of the work, they shall be furnished and installed.
- G. Rough-in dimensions and locations shall be verified with the supplier of all equipment furnished by other trades or by the Owner prior to the time of roughing-in.
- H. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. Minor deviations from the contract drawings may be made to allow for better accessibility, but changes of magnitude, or which involve extra cost, shall not be made without approval.
- I. Ample space shall be allowed for removal of all parts that may require replacement or service in the future.

1.7 RECORD DOCUMENTS:

- A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate the following installed conditions:
 - 1. Ductwork mains and branches, size and location; locations of dampers and other control devices, filters, and units requiring periodic maintenance or repair.
 - 2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located, valve location diagrams, complete with valve tag chart. Refer to Division 15 Section "Mechanical Identification." Indicate actual inverts and horizontal locations of underground piping.
 - 3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 5. During construction, maintain a complete and legible set of drawings, showing changes and deviations between actual construction and Engineer's drawings. Drawings shall be updated and corrected to reflect "as-built" conditions and a record set submitted to Owner upon completion of project.

1.8 OPERATING AND MAINTENANCE MANUALS:

- A. Prepare bound sets of operating and maintenance manuals in accordance with Division 1 Section "PROJECT CLOSE-OUT." In addition to the requirements specified in Division 1, include the following information for equipment items:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, and 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 assembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.9 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to the project site properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. All construction related products and equipment received at project site shall be secured and stored neatly, in original packaging, and protected from the elements in an Owner designated, on-site storage area.
- C. All construction related products and equipment shall be handled, moved, lifted and placed in accordance with all manufacturers' posted and written instructions. Equipment and/or product damage incurred due to improper handling shall be repaired to like new condition by the Contractor causing said damage. If the damaged item cannot be repaired to a like new condition then the item shall be replaced with new by the Contractor causing said damage at no additional cost increase in the contract amount.

1.10 CODES, FEES, AND MISCELLANEOUS COSTS:

- A. All construction shall comply with all applicable specifications, codes, local ordinances, industry standards, and utility company regulations.
- B. In case of variations between specifications, codes, laws, applicable regulations, and the Contract Documents, the most stringent requirement shall govern the work done. The Contractor shall **Promptly** notify the Engineer in writing of any such discrepancy.
- C. Should the Contractor perform work that does not comply with the standards governing the construction of this project, he shall bear all costs incurred to correct work that does not comply with the set standards.

1.11 TEMPORARY FACILITIES

- A. Temporary Utilities: The types of services required include, but are not limited to, water, sewerage, surface drainage and gas. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.
 1. Sewer Sediment: Maintain sewers and temporary connecting sewers in a clean, non-clogged condition during construction period.
- B. Construction Facilities: Provide facilities reasonably required to perform construction operations properly and adequately.
 1. Enclosures: When temporary enclosures are required to ensure adequate workmanship, weather protection and ambient conditions required for the work, provide fire-retardant treated lumber and plywood; provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.
 2. Heating: Provide heat, as necessary, to protect work, materials and equipment from damage due to dampness and cold. In areas where building is occupied, maintain a temperature not less than 65 degrees Fahrenheit. Use steam, hot water, or gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls.

Use electric-resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable.

PART 2 - PRODUCTS:

NOT APPLICABLE

PART 3 - EXECUTION:

3.1 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.2 MECHANICAL INSTALLATIONS:

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - 7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
 - 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- B. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 - 1. Install access doors in ducts at all fire damper locations. Access doors are specified in Division 15 Section 15910 - "DUCTWORK ACCESSORIES".

2. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
3. The Architect/Engineer reserves the right to require minor adjustments (maximum of 10'-0") in location of switches, blocking, ductwork, conduits, drains, piping, outlets, switches and/or equipment at no additional charge if so directed prior to their installation.
4. Where the Drawings show equipment, casework, or the like, Contractors shall lay out the work to avoid conflicts. Where offsets in piping, additional fittings, necessary drains, minor valves, traps, devices, etc., are required to complete the installation, to clear obstructions or the work of other Contractors, or for the proper operation of the system, these shall be deemed to be included in the Contract and shall be furnished and installed complete by the Contractor at no additional charge.

END OF SECTION 15010

SECTION 15030 - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED SECTIONS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.

1.2 SUMMARY:

- A. This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory-installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the drawings.

1.3 RELATED DOCUMENTS:

- A. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 16.

1.4 REFERENCES:

- A. NEMA Standards MG 1: Motors and Generators.
- B. NEMA Standard ICS 2: Industrial Control Devices, Controller, and Assemblies.
- C. NEMA Standard 250: Enclosures for Electrical Equipment.
- D. NEMA Standard KS 1: Enclosed Switches.
- E. The current edition of The National Electrical Code:

1.5 SUBMITTALS:

- A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.6 QUALITY ASSURANCE:

- A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.1 MOTORS:

- A. The following are basic requirements for simple or common motors. All motors used with variable frequency drives shall be "Premium efficiency" and shall be VFD compatible. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
 - 1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
 - 2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range. 2-speed motors shall have separate windings. Motor starters shall be supplied by motor manufacturer.
 - 3. Temperature Rating: Rated for 40 deg. C environmental with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).

4. Starting capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.
5. Service Factor: 1.15 for multiphase motors and 1.35 for single-phase motors.
6. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
 - a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
 - b. Bearings:
 - 1) Ball or roller bearings with inner and outer shaft seals;
 - 2) Greaseable, except permanently sealed where motor is normally inaccessible for regular maintenance;
 - 3) Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
 - 4) For fractional horsepower, light duty motors, sleeve type bearings are permitted.
 - c. Enclosure Type:
 - 1) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
 - 2) Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - 3) Weather protected Type I for outdoor use, Type II where not housed;
 - d. Overload protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
 - e. Noise rating: "Quiet".
 - f. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, test method B.
 - g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

2.2 STARTERS, ELECTRICAL DEVICES, AND WIRING:

- A. Motor Starter Characteristics:
 1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC proper class and division.
 2. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
- B. Manual switches shall have:
 1. Pilot lights and extra positions for multi-speed motors.
 2. Overload protection: Melting alloy type thermal overload relays.
- C. Magnetic Starters:

1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
 2. Trip-free thermal overload relays, each phase.
 3. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division-15 Controls section.
 4. Built-in 120-volt control circuit transformer, fused on line and load side, where service exceeds 120 volts.
 5. Externally operated manual reset.
 6. Under-voltage release or protection.
 7. Phase failure protection on all poly-phase motors.
- D. Motor connections:
1. Flexible conduit, except where plug-in electrical cords are specifically indicated.
- 2.3 DISCONNECT SWITCHES:
- A. Fusible switches: Fused, each phase, heavy duty; horsepower rated; non-teasible
 - B. quick-make, quick-break mechanism; dead front line side shield; Solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated or required for the intended duty.
 - C. Non-fusible switches: For equipment 2 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated or required for the duty. For equipment larger than 2 horsepower, switches shall be the same as fusible type.
- 2.4 CAPACITORS:
- A. Features:
 1. Individual unit cells
 2. All welded steel housing
 3. Each capacitor internally fused
 4. Non-flammable synthetic liquid impregnant
 5. Craft tissue insulation
 6. Aluminum foil electrodes
 - B. Size: KVAR size shall be as required to correct motor power factor to 90 percent or better.

PART 3 - EXECUTION

- 3.1 This Contractor shall provide disconnect switches, motor starters, and other electrical devices as required by the National Electrical Code and as required for proper operation of his equipment except where specifically specified and scheduled to be provided by another trade.
- 3.2 Electrical equipment required for packaged mechanical equipment shall be installed in like manner as individually specified electrical equipment. Refer to Division 16 for installation requirements.
- 3.3 Power factor correction capacitors shall be installed on all motors 1 horsepower and larger that have an uncorrected power factor of less than 85% at rated load.

END OF SECTION 15030

SECTION 15042 - TESTING AND PROOF OF PERFORMANCE

PART 1 - GENERAL

1.1 RELATED SECTIONS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.

1.2 WORK DESCRIPTION:

A. Scope of Work:

- 1. Perform all tests as specified herein under the supervision of the Architect/Engineer or his duly authorized representative.

B. Work Included:

- 1. Low pressure supply, return, outside air and exhaust systems
- 2. Domestic water distribution piping
- 3. Sewer, soil, and waste piping system
- 4. Natural gas piping system

1.3 SUBMITTALS:

A. Reports:

- 1. Accurately record and report the methods of testing, times, and dates of the test, witnesses to the test, and the results of the test. The test reports shall be neatly typewritten on standard 8-1/2" x 11" sheets and submitted in five (5) copies to the Architect/Engineer for approval within five (5) days after the test has been performed.

1.4 CONDITIONS:

A. Scheduling:

- 1. As much as practical, tests shall be scheduled to allow an Owner's representative to witness the test. In every case, the Owner's representative shall be notified a minimum of forty-eight (48) hours prior to anticipated testing.

B. Partial Testing:

- 1. As much as practical, systems shall be tested complete as systems. Tests on portions of a system are authorized to allow for proper progress scheduling. When systems are tested in segments, a separate and complete report is required for each segment. Segmented reports shall include a system diagram indicating portion of system tested.

C. Defective Joints:

- 1. All leaking joints shall be completely disassembled and remade using new materials.

D. Concealed Work:

- 1. Concealed Work (including underground) shall be tested and results approved by the Architect/Engineer prior to covering up.
- 2. Insulated work shall be tested and test to witnessed by the Architect/Engineer prior to application of the insulation.

PART 2 - PRODUCTS

2.1 TESTING EQUIPMENT:

A. Instrumentation:

1. All instruments used shall be accurately calibrated and maintained in good working condition.

PART 3 - EXECUTION

3.1 TESTING PROCEDURES:

A. Low Pressure Ductwork

1. This article shall apply to environmental ducts (supply, return, and exhaust) Duct Class 3" w.g. designed for operation at Seal Class B and Leakage Class 6.
2. All ductwork in concealed, inaccessible locations (i.e., within shafts, above hard ceilings, etc.) shall be pressurized to 2" w.g., and all seams and joints shall be surveyed for leakage. Leaking joints shall be cleaned and resealed with new materials prior to being enclosed.
3. All other ductwork shall be surveyed during the test and balancing process and any leaks found shall be cleaned and resealed with new materials.
4. Leakage shall not exceed 9 CFM per 100 S.F. of duct surface at 2" w.g. test pressure in compliance with the recommendations of SMACNA HVAC Air Duct Leakage Test Manual.

B. Domestic Water:

1. Piping shall be tested, and results approved by Architect/Engineer prior to application of insulation.
2. Piping system shall be capped and subjected to a static air pressure of 50 psig above operating pressure (minimum 125 psig), and pressure maintained for 4 hours with no leaks or loss in pressure.
3. Test source shall be isolated before conducting pressure tests.

C. Storm, Soil, and Waste Piping:

1. Underground sanitary and storm piping shall be tested, and results approved by the Architect/Engineer prior to covering with backfill.
2. Storm, soil, and waste piping shall be plugged and subjected to 120" static water head. Water column shall be maintained for 15 minutes with no leaks.
3. Prior to hydrostatic testing, the Contractor shall demonstrate to the Owner that all storm, soil, and waste piping underslab is free and clear of all dirt and debris by means of "sewer cams" providing both direct visual display and future playback via a digital media. The cameras shall be of sizes appropriate to the diameter of piping to be reviewed, and the tethers shall be of sufficient length to view all portions of the piping.

D. Natural Gas Piping:

1. Piping shall be tested in accordance with the requirements of the Utility and NFPA 54.
2. Piping shall be filled with air or an inert gas to a minimum pressure of 2 psig above delivery pressure and maintained for not less than 1 hour with no pressure loss.
3. The test source of pressure shall be isolated before conducting pressure tests.

E. Compressed Air Piping:

1. Pressure test at 50 lbs. above maximum pressure for 4 hours.

END OF SECTION 15042

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SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.
- B. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:
 - 1. Mechanical equipment nameplate data.
 - 2. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment.
 - 3. Miscellaneous metals for support of mechanical materials and equipment.
 - 4. Joint sealers for sealing around mechanical materials and equipment.

1.2 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. Product data for the following products:
 - a. Joint sealers.
 - 2. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.

1.3 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers.
- B. Quality welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.5 PROJECT CONDITIONS:

- A. Conditions Affecting Excavations: The following project conditions apply:
 - 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
 - 2. Site Information: Subsurface conditions where investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.

3. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.
4. Remove existing underground utilities indicated to be removed.
 - a. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.
 - b. Provide temporary utility services to affected areas. Provide minimum of 48-hour notice to Architect/Engineer prior to utility interruption.
- B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA:

- A. Nameplate: For each piece of power operated mechanical equipment, provide a permanent operations data nameplate indicating manufacturer, project name, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.2 SOIL MATERIALS:

- A. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.
- B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.
- C. Backfill and Fill Materials: Materials complying with ASTM D 2487 soil classification groups GW, GP, GM, SW, and SP; free of clay, rock, or gravel larger than 2 inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

2.3 MISCELLANEOUS METALS:

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.
- F. Fasteners: Zinc-coated, type, grade, and class as required.

2.4 JOINT SEALERS:

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacture's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
 1. Acrylic-Emulsion Sealants: One-part, nonsag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
 1. Fire Barrier Penetration Seals are specified in Section 07840 - Fire Stopping.

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 installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION FOR JOINT SEALERS:

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
- B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.3 EXCAVATION:

- A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
- B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
 - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- C. Install sediment and erosion control measures in accordance with local codes and ordinances.
- D. Dewatering: Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.
 - 1. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- E. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
- F. Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services other construction, and for inspection.
 - 1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
 - 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- G. Trenching: Excavate trenches for mechanical installations as follows:
 - 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of pipe and equipment.
 - 2. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.

3. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of pipe. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and pipe.
4. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.
 - a. For pipes or equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom 1/4 of the circumference. Fill unevenness with tamped sand backfill. At each pipe joint over-excavate to relieve the bell or pipe joint of the pipe of loads, and to ensure continuous bearing of the pipe barrel on the bearing surface.
- H. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg C).
- I. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
 1. Under walks and pavements, use a combination of sub base materials and excavated or borrowed materials.
 2. Under building slabs, use drainage fill materials.
 3. Under piping and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 4. For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of piping, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
- J. Backfill excavations as promptly as work permits, but not until completion of the following:
 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.
- K. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- L. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- M. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- N. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.
 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of

relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

- a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
- b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
- O. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- P. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGE:

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

3.5 APPLICATION OF JOINT SEALERS:

- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
 - 2. Comply with recommendations of ASTM C 790 for use of acrylic- emulsion joint sealants.
- B. Tooling: Immediately after sealant application and prior to time shining or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contract and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around mechanical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

END OF SECTION 15050

SECTION 15060 - BASIC PIPING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.
- B. Related Mechanical Specification Sections:
 - 1. Section 15010 - Basic Mechanical Requirements
 - 2. Section 15042 - Testing and Proof of Performance
 - 3. Section 15050 - Basic Mechanical Materials and Methods
 - 4. Section 15100 - Valves
 - 5. Section 15120 - Piping Specialties
 - 6. Section 15140 - Supports and Anchors
 - 7. Section 15190 - Mechanical Identification
 - 8. Section 15250 - Mechanical Insulation

1.2 DESCRIPTION OF WORK:

- A. This Section specifies materials and installation methods common to more than one section of Division 15 and includes joining materials, piping specialties, and basic piping installation instructions.
- B. Products Included:
 - 1. Piping Sleeves
 - 2. Unions and Fittings
 - 3. Strainers

1.3 SUBMITTALS:

- A. Refer to Division 1 and Basic Mechanical Requirements for administrative and procedural requirements for submittals.
- B. Product Data: Submit product data on the following items:
 - 1. Unions and Fittings
 - 2. Strainers
- C. Quality Control Submittals:
 - 1. Submit welders' certificates specified in Quality Assurance below.

1.4 QUALITY ASSURANCE:

- A. Welder's Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- B. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.
- C. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for hub-and-spigot pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS:

- A. Refer to individual piping system Specification Sections in division 15 for Specifications on piping and fittings relative to that particular system.

2.2 JOINING MATERIALS:

- A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.
- C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.
- D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.3 SLEEVES:

- A. Sheet-Metal Sleeves: 20 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.
- B. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.2 INSTALLATIONS:

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.
- B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.

- C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless specifically indicated on the Drawings.
- E. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.
- H. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.

3.3 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

- A. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish, and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
 - 1. Install 20 gauge galvanized sheetmetal sleeves at interior wallboard, drywall, or plasterboard partitions and ceilings other than suspended ceilings.
 - 2. Install steel-pipe sleeves at all other penetrations and at exterior penetrations above grade.

3.4 JOINTS:

- A. Steel Pipe Joints:
 - 1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- B. Pipe Larger Than 2":
 - 1. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.
 - 2. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.
- C. Non-ferrous Pipe Joints:

1. Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 - Standard Code for Pressure Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.
 - a. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered or brazed joints.
 - b. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
 2. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.
- D. Joints for other piping materials are specified within the respective piping system sections.
- 3.5 FIELD QUALITY CONTROL:
- A. Testing: Refer to individual piping system specification sections.

END OF SECTION 15060

SECTION 15100 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.
- B. Requirements of the following Division 15 Sections apply to this section:
 - 1. "Basic Mechanical Requirements."
 - 2. "Basic Mechanical Materials and Methods."
 - 3. "Basic Piping Materials and Methods."

1.2 SUMMARY:

- A. This Section includes general duty valves common to most mechanical piping systems. Special purpose valves are specified in individual piping system specifications.
- B. Valve tags and charts are specified in Division 15 Section "MECHANICAL IDENTIFICATION."

1.3 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data, including body material, valve design, pressure and temperature classification, end connection details, seat materials, trim material and arrangement, dimensions and required clearance installation instructions.

1.4 QUALITY ASSURANCE:

- A. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
- B. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Preparation For Transport: Prepare valves for shipping as follows:
 - 1. Ensure valves are dry and internally protected against rust and corrosion.
 - 2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
 - 3. Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.
- B. Storage: Use the following precautions during storage:
- C. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
- D. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.
- E. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheel and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Crane, Hammond, Grinnell, Milwaukee, Mueller Steam Specialty, Nibco, Stockham, Apollo, Keystone.

2.2 VALVE FEATURES, GENERAL:

- A. Valve Design: Rising stem or rising outside screw and yoke stems.
 - 1. Non-rising stem valves may be used where headroom prevents full extension of rising stems.
- B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.
- C. Sizes: Same size as upstream pipe, unless otherwise indicated.
- D. Operators: Provide the following special operator features:
 - 1. Handwheel fastened to valve stem, for valves other than quarter turn.
 - 2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 10 plug valves.
- E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.
- G. End Connections: As indicated in the valve specifications.
 - 1. Threads: Comply with ANSI B1.20.1.
 - 2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
 - 3. Solder-Joint: Comply with ANSI B16.18.
 - 4. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg F for ball valves.

2.3 GATE VALVES:

- A. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 125, body and bonnet of ASTM B 62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 150 valves meeting the above where system pressure requires.
- B. Gate Valves, 2-1/2-Inch and Larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

2.4 BALL VALVES:

- A. Ball Valves, 2 Inch and Smaller: MSS SP-110; Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; two-piece construction; with bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.
- B. Ball Valves, 2-1/2" and larger: Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; 3-piece construction; with bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout

proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.

2.5 PLUG VALVES:

- A. Plug Valves, 2-Inch and Smaller: Rated at 150 psi WOG; bronze body, with straight-away pattern, square head, and threaded ends.
- B. Plug Valves, 2-1/2-Inch and Larger: MSS SP-78; rated at 175 psi WOG; lubricated plug type, with semisteel body, single gland, wrench operated, and flanged ends.

2.6 GLOBE VALVES:

- A. Globe Valves, 2-Inch and Smaller: MSS SP-80; Class 125; body and screwed bonnet of ASTM B 62 cast bronze; with threaded or solder ends, brass or "Teflon" disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 150 valves meeting the above where system pressure requires.

2.7 BUTTERFLY VALVES:

- A. Butterfly Valves, 2-1/2-Inch and Larger: MSS SP-67; rated at 200 psi; cast-iron body conforming to ASTM A 126, Class B. Provide valves with field replaceable EPDM sleeve, aluminum bronze disc, stainless steel stem, and EPDM O-ring stem seals. Provide lever operators with locks and memory stops for sizes 2 through 6 inches and gear operators with position indicator for sizes 8 through 24 inches. Provide lug or wafer type as indicated. Lug-type valves on dead-end service or requiring additional body strength.

2.8 CHECK VALVES:

- A. Swing Check Valves, 2-Inch and Smaller: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze or "Teflon" disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.
- B. Lift Check Valves, 2-Inch and Smaller: Class 125; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Provide valves capable of being refitted and ground while the valve remains in the line.

PART 3 - EXECUTION

3.1 VALVE INSTALLATIONS:

- A. General Application: Use gate, ball, and butterfly valves for shut-off duty; globe, ball, and butterfly for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.
- D. Install three-valve bypass around each pressure-reducing valve using throttling-type valves.
- E. Install valves in horizontal piping with stem at or above the center of the pipe.
- F. Install valves in a position to allow full stem movement.
- G. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.
2. Lift Check Valve: With stem upright and plumb.

3.2 FIELD QUALITY CONTROL:

- A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.3 ADJUSTING AND CLEANING:

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

END OF SECTION 15100

SECTION 15120 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of piping specialties work required by this section is indicated on drawings and schedules and by requirements of this section.
- B. Types of piping specialties specified in this section include the following:
 - 1. Pipe Escutcheons
 - 2. Dielectric Unions
 - 3. Water Hammer Arresters
 - 4. Pressure Regulating Valves
 - 5. Relief Valves
- C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, scale range, location, and features for each pipeline specialty.
- B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.
- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 PIPE ESCUTCHEONS:

- A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings, and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
- B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
- C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe escutcheons which may be incorporated in the work include; but are not limited to, the following:

- E. Manufacturers: Subject to compliance with requirements, provide pipe escutcheons of one of the following:
 - 1. Chicago Specialty Mfg. Co.
 - 2. Producers Specialty & Mfg. Corp.
 - 3. Sanitary-Dash Mfg. Co.

2.2 DIELECTRIC UNIONS:

- A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.
- B. Manufacturers: Subject to compliance with requirements, provide dielectric unions of one of the following:
 - 1. B & K Industries, Inc.
 - 2. Capital Mfg. Co.; Div. of Harsco Corp.
 - 3. Eclipse, Inc.
 - 4. Epco Sales, Inc.
 - 5. Perfection Corp.
 - 6. Rockford-Eclipse Div.

2.3 WATER HAMMER ARRESTERS:

- A. General: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.
- B. Manufacturers: Subject to compliance with requirements, provide water hammer arresters of one of the following:
 - 1. Amtrol, Inc.
 - 2. Josam Mfg. Co.
 - 3. Smith (Jay R.) Mfg. Co.
 - 4. Tyler Pipe; Sub. of Tyler Corp.
 - 5. Zurn Industries, Inc.; Hydromechanics Div.

2.4 WATER PRESSURE REGULATING VALVES:

- A. Pressure Regulating Valves: Single seated, direct operated type; having bronze body with integral strainer, and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.
- B. Manufacturers: Cash, Claval Co., Spence, Watts Regulator.

2.5 RELIEF VALVES:

- A. Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.
- B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 deg F, and pressure relief at 150 psi.
- C. Manufacturers: Cash Watts, Zurn.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES:

- A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.
- B. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.
- C. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, at the top of all hot and cold domestic water risers, at the end of each water header in utility spaces, at the top of all branches to fixtures, at each solenoid valve or equipment with a quick closing valve.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

- A. Pipe Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer.
 - 1. Install sleeves accurately centered on pipe runs.
 - 2. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run.
 - 3. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation.
 - 4. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves.
 - 5. Extend floor sleeves 1/4" above level floor finish, and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
 - 6. Install 20 gauge galvanized sheet-metal sleeves at wallboard, drywall, or plaster board interior partitions and ceilings other than suspended ceilings.
 - 7. Install steel-pipe sleeves at all other penetrations and at exterior penetrations; both above and below grade.

END OF SECTION 15120

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SECTION 15135 - METERS AND GAGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of meters and gages required by this section is indicated on drawings and/or specified in other Division-15 section.
- B. Types of meters and gages specified in this section include the following:
 - 1. Pressure Gages and Fittings
 - a. Pressure Gages
 - b. Pressure Gage Cocks
 - c. Pressure Gage Connector Plugs
- C. Meters and gages furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of meters and gages, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. UL Compliance: Comply with applicable UL standards pertaining to meters and gages.
 - 2. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.
- C. Certification: Provide meters and gages whose accuracies, under specified operating conditions, are certified by manufacturer.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gage. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gage schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gage.
- B. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gage. Include this data and product data in Maintenance Manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES:

- A. General: Provide pressure gages of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

- B. Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.
- C. Case: Drawn steel or brass, glass lens, 4 1/2" diameter.
- D. Connector: Brass with 1/4" male NPT. Provide protective siphon when used for steam service.
- E. Scale: White coated aluminum, with permanently etched markings.
- F. Range: Conform to the following:
 - 1. Vacuum: 30" Hg - 15 psi.
 - 2. Water: 0 - 100 psi.
- G. Manufacturers: Subject to compliance with requirements, provide pressure gages of one of the following:
 - 1. Ametek/U.S. Gauge.
 - 2. Marsh Instrument Co.; Unit of General Signal.
 - 3. Marshalltown Instruments, Inc.
 - 4. Miljoco
 - 5. Weiss Instruments, Inc.

2.2 PRESSURE GAGE COCKS:

- A. General: Provide pressure gage cocks between pressure gages and gage tees on piping systems. Construct gage cock of brass with 1/4" female NPT on each end, and "T" handle brass plug.
- B. Snubber: 1/4" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.
- C. Manufacturers: Same as for pressure gages.

2.3 PRESSURE GAGE CONNECTOR PLUGS:

- A. General: Provide pressure gage connector plugs pressure rated for 500 psi and 200 F (93 °C). Construct of brass and finish in nickel-plated equip with 1/2" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion pressure gage. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.
- B. Manufacturer: Subject to compliance with requirements, provide pressure gage connector plugs of one of the following:
 - 1. Peterson Equipment Co.
 - 2. Sisco

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which meters and gages are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PRESSURE GAGES:

- A. General: Install pressure gages in piping tee with pressure gage cock, located on pipe at most readable position.
- B. Locations: Install in the following locations, and elsewhere as indicated:

1. At suction and discharge of each pump.
 2. At discharge of each pressure reducing valve.
 3. At water service outlet.
- C. Pressure Gage Cocks: Install in piping tee with snubber.
- D. Pressure Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.
- 3.3 ADJUSTING AND CLEANING:
- A. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.
- B. Cleaning: Clean windows of meters and gages and factory finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION 15135

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SECTION 15140 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK:

- A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Types of supports and anchors specified in this section include the following:
 - 1. Horizontal-Piping Hangers and Supports
 - 2. Vertical-Piping Clamps
 - 3. Hanger-Rod Attachments
 - 4. Building Attachments
 - 5. Saddles and Shields
 - 6. Miscellaneous Materials
 - 7. Roof Piping Supports
 - 8. Roof Equipment Supports
 - 9. Anchors
 - 10. Equipment Supports
- C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
 - 2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
 - 3. MSS Standard Compliance:
 - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
 - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
 - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
 - d. Terminology used in this section is defined in MSS SP-90.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule

showing Manufacturer's figure number, size, location, and features for each required pipe hanger and support.

- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

- A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
- B. Adjustable Steel Clevis Hangers: MSS Type 1.
- C. Pipe Hangers: MSS Type 5.
- D. Adjustable Steel Band Hangers: MSS Type 7.
- E. Extension Split Pipe Clamps: MSS Type 12.
- F. U-Bolts: MSS Type 24.
- G. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
- H. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.

2.2 VERTICAL-PIPING CLAMPS:

- A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- B. Two-Bolt Riser Clamps: MSS Type 8.

2.3 HANGER-ROD ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. Steel Turnbuckles: MSS Type 13.
- C. Malleable Iron Sockets: MSS Type 16.

2.4 BUILDING ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

- B. Concrete Inserts: MSS Type 18.
- C. Side Beam or Channel Clamps: MSS Type 20.
- D. Center Beam Clamps: MSS Type 21.
- E. Top Beam Clamps: MSS Type 25.
- F. Side Beam Clamps: MSS Type 27.
- G. Steel Brackets: One of the following for indicated loading
 - 1. Light Duty: MSS Type 31.
 - 2. Medium Duty: MSS Type 32.
 - 3. Heavy Duty: MSS Type 33.
- H. Side Beam Brackets: MSS Type 34.

2.5 SADDLES AND SHIELDS:

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
- C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.6 MANUFACTURERS OF HANGERS AND SUPPORTS:

- A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - 1. B-Line Systems Inc.
 - 2. Carpenter and Patterson, Inc.
 - 3. Corner & Lada Co., Inc
 - 4. Elcen Metal Products Co.
 - 5. Fee & Mason Mfg. Co.; Div. Figgie International.
 - 6. Anvil International Inc. (formerly ITT Grinnel)

2.7 MISCELLANEOUS MATERIALS:

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

2.8 ROOF PIPE SUPPORTS:

- A. General: Pillow block type pipe stand with roller piping support to absorb thermal piping expansion and contraction for roof-mounted gas piping.
- B. Manufacturers: Subject to compliance with requirements, provide roof piping supports of one of the following:

1. Cooper B-Line, Inc C-Port
 2. Miro Industries, Inc.
 3. Portable Pipe Hangers, Inc
- C. Configurations:
1. For piping 3" and smaller; Provide units comprised of a rigid polycarbonate resin base and polycarbonate resin roller suspended on a nylon rod. Provide manufacturer's optional spaces as required compensate for varied roof slope and at piping branches from the main. Basis of Design; Miro Industries Model 3-R
 2. For piping 4" and larger; Provide units comprised of a steel base and rod support assembly supporting a heavy-duty SBR rubber or polycarbonate roller. Basis of Design; Miro Industries Model 6-RAH-PC

2.9 ROOF EQUIPMENT SUPPORTS:

- A. General: Construct roof equipment supports using minimum 18-gage galvanized steel with fully mitered and welded corners, 3" cant, internal bulkhead reinforcing, integral base plates, pressure treated wood nailer, and 18-gage galvanized steel counterflashing.
- B. Configuration: Construct to sizes as indicated, compensate for slope in roof so top of support is dead level.
- C. Manufacturers: Subject to compliance with requirements, provide roof equipment supports of one of the following:
 1. Custom Curb, Inc.
 2. Pate Co.
 3. Thycurb Div.; Thybar Corp.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.
- B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.3 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.4 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Existing concrete floor slabs for piping less than 1 ½" diameter: In concrete floor slabs where no inserts are in place, anchoring into the existing concrete shall be done with expansion screw anchors and/or other means approved by the Engineer. At no time shall anchors be greater than 5/8" diameter.
- D. Existing concrete floor slabs for piping 1 ½" and larger: In concrete construction where no inserts are in place, Unistrut or equal supports shall be fastened to the slab and have a continuous length between at least two joists, beams or columns. Unistrut shall be sized as recommended by the manufacturer for hanging indicated diameter piping. Anchoring into existing concrete shall be done with expansion screw anchors and/or other means approved by the Engineer.
- E. Existing concrete beams and joists: In concrete construction where no inserts are in place, steel hanger rod clips shall be fastened to the sides of joists or beams as necessary for hanging indicated diameter piping. Anchoring shall be done with expansion screw anchors and/or other means as approved by the Engineer. Anchors shall be located at least 3" from the bottom of joists and 5" from the bottom of beams. Anchors for hangers shall not be inserted in the bottom of concrete beams or joists.
- F. Support fire protection system piping independently of other piping.
- G. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- H. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- I. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- K. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields.
 - 3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.
 - 4. **At all warehouse areas without a ceiling, install zip ties around all insulation shields to prevent dislocation due to thermal expansion of piping.**

3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required accommodating both expansion and contraction of piping.

3.6 EQUIPMENT SUPPORTS:

- A. Provide concrete housekeeping bases for all floor-mounted equipment furnished as part of the work of Division 15. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.
- B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.
- C. Furnish roof equipment supports to Contractor for installation as part of work of Division 7; not work of this section.

3.7 ADJUSTING AND CLEANING:

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 15140

SECTION 15190 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections and other Division-15 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Types of identification devices specified in this section include the following:
 - 1. Plastic Pipe Markers.
 - 2. Plasticized Tags.
- C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division-15 sections.
- D. Refer to Division-16 sections for identification requirements of electrical work; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Schedules: Submit valve schedule for each piping system, type written and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
 - 1. Brady (W. H.) Co.; Signmark Div.
 - 2. Seton Name Plate Co.
 - 3. Marking Services Incorporated
 - 4. Brimar Industries, Inc.

2.2 MECHANICAL IDENTIFICATION MATERIALS:

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-15 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.3 PLASTIC PIPE MARKERS:

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 F (52 C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
- D. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - 2. Adhesive lap joint in pipe marker overlap.
 - 3. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
- E. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
 - 1. Laminated or bonded application of pipe marker to pipe (or insulation).
 - 2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
 - 3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
- F. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Engineer in cases of variance with name as shown or specified.
 - 1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.4 PLASTIC TAPE:

- A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
- B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
- C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.5 PLASTICIZED TAGS:

- A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matte finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS:

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting, or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING SYSTEM IDENTIFICATION:

- A. General: Install pipe markers of the following type on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - 1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.
- B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - 1. Near each valve and control device.
 - 2. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - 3. Near major equipment items and other points of origination and termination.
 - 4. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment, including mechanical rooms.

3.3 ADJUSTING AND CLEANING:

- A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.4 MECHANICAL EQUIPMENT IDENTIFICATION:

- A. Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 - 1. Pumps, condensing units and similar motor driven equipment.
 - 2. Fans and blowers.
 - 3. Packaged HVAC rooftop units.

3.5 EXTRA STOCK:

- A. Stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

END OF SECTION 15190

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SECTION 15250- MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections apply to work of this Section

1.2 DESCRIPTION OF WORK:

- A. Furnish and install thermal insulation materials and accessories for mechanical systems as specified. Extent of mechanical insulation work required by this Section is indicated on drawings, schedules and by requirements of this Section. Lack of specific notation on the drawings, however, does not relieve the Contractor of the responsibility for fully insulating all piping, ductwork, and equipment as herein specified.
- B. Types of mechanical insulation specified in this Section include the following:
 - 1. Piping System Insulation:
 - a. Flexible Unicellular
 - 2. Ductwork System Insulation:
 - a. Fiberglass
 - 3. Equipment Insulation:
 - a. Flexible Unicellular
 - 4. Exterior Duct and Pipe Covering
 - a. Aluminum Jacket
 - b. Foil/film Facing

1.3 QUALITY ASSURANCE:

- A. Reference Standards:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
 - a. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.
 - b. Exception: Mechanical insulation installed outdoors may have flame spread index of 75 and smoke developed index of 150.
 - 2. National Commercial & Industrial Insulation Standards – Current Edition
 - 3. *[Specifier—insert site specific energy code.]*
- B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

1.4 SUBMITTALS:

- A. Product Data:
 - 1. Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation.

2. Submit schedule showing manufacturer's product number, k-value, thickness, density in lbs./cu. ft., and furnished accessories for each mechanical system requiring insulation.
- B. Where specified herein, submit manufacturer's sample of each piping, ductwork, and equipment insulation type required. Affix label to sample which completely describes product sample.
- C. Submit maintenance manuals in accordance with Division 1 specification requirements:
 1. Maintenance manuals shall include the following:
 - a. Maintenance data
 - b. Replacement material lists for each type of mechanical insulation provided.

1.5 DELIVERY STORAGE AND HANDLING:

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation, or insulation that has been previously wetted and dried out; remove from project site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Insulation Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following. The products of only one manufacturer shall be used for each particular insulation application.
 1. Armstrong World Industries, Inc.
 2. Certainteed Corp.
 3. Knauf Fiber Glass GmbH
 4. Johns-Manville Corp.
 5. Manson Insulation Corporation
 6. Owens-Corning Fiberglass Corp.
 7. Pittsburgh Coming Corp.
 8. Rubatex Corp.
- B. Exterior Foil/Film Facing
 1. Venture Tape Corporation VentureClad 1577CW
 2. Permaguard Alumaguard Lite Silver
 3. Knauf Redi-Klad 1000 Pipe insulation

2.2 PIPING INSULATION MATERIALS:

- A. Flexible Unicellular Piping Insulation: ASTM C534, Type I or Type II. (For use between -40 degrees F and 220 degrees F only.)
 1. Elastomeric foam insulation, flexible, closed-cell construction, 0.27 Btu•inch/sq. ft./°F/hour maximum "k" factor at 75°F differential. *[Specifier— Modify the K-factor as appropriate for different thicknesses and densities.]*
 2. 6 pound per cubic foot density, 0.20 perm maximum water vapor transmission, physically and chemically stable from -40°F to 220°F, ASTM C534, Type I - tubular

or Type II - sheet. *[Specifier—edit insulation density and thickness as required to meet energy code.]*

B. Adhesives Sealers and Protective Finishes:

1. As recommended by insulation manufacturer for applications indicated.

2.3 DUCTWORK INSULATION MATERIALS:

A. Rigid Fiberglass Ductwork Insulation: ASTM C612, Class 1., Foil Scrim Kraft (FSK) Facing.

1. Rigid fiberglass ductwork insulation, 0.23 Btu•inch/sq. ft./°F/hour maximum “k” factor at 75°F differential. *[Specifier— Modify the K-factor as appropriate for different thicknesses and densities.]*
2. 3 pound per cubic foot minimum density, ASTM C612, Class 1, with barrier jacket constructed of FSK laminated to fire resistive kraft suitable for use to 450 degrees F. *[Specifier—edit insulation density and thickness as required to meet energy code.]*

B. Flexible Fiberglass Ductwork Insulation: ASTM C553, Type I, Class B-3, FSK facing.

1. Flexible fiberglass blanket insulation, 0.27 Btu•inch/sq. ft./°F/hour maximum “k” factor at 75°F differential. *[Specifier— Modify the K-factor as appropriate for different thicknesses and densities.]*
2. 1 pound per cubic foot minimum density, ASTM C553, Type I, with 0.002” aluminum reinforced foil-scrim-kraft (FSK) jacket suitable for use to 250 degrees F. *[Specifier—edit insulation density and thickness as required to meet energy code.]*

C. Jackets for Ductwork Insulation: ASTM C 1136 for all ductwork.

1. TYPE I - VAPOR BARRIER, FOIL SCRIM KRAFT, (FSK)

D. Ductwork Insulation Accessories:

1. Provide pins, washers, tape, and similar accessories as recommended by insulation manufacturer for applications indicated.

2.4 EQUIPMENT INSULATION MATERIALS:

A. Elastomeric Foam Insulation: ASTM C534, Type II. (For use between -40 degrees F and 220 degrees F only.)

1. Elastomeric foam insulation, flexible, closed-cell construction, 0.27 Btu•inch/sq. ft./°F/hour maximum “k” factor at 75°F differential. *[Specifier— Modify the K-factor as appropriate for different thicknesses and densities.]*
2. 6 pound per cubic foot density, 0.20 perm maximum water vapor transmission, physically and chemically stable from -40°F to 220°F, ASTM C534 Type II - sheet. *[Specifier—edit insulation density and thickness as required to meet energy code.]*

B. Equipment Insulation Compounds:

1. Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

C. Equipment Insulation Accessories:

1. Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

2.5 EXTERIOR DUCTWORK, PIPING, AND EQUIPMENT

A. Foil/Film Facing for ductwork

1. Jacketing shall be a five-ply laminated foil/film facing for exterior applications. Product shall be a five-ply laminate alternating layers of aluminum foil (core and outer layers) with two layers of polyester film. Substrate thickness shall be not less than 3.0 mils and the adhesive thickness shall be not less than 2.0 mils.
2. Product shall be coated with cold weather acrylic, pressure sensitive adhesive system suitable for application in below freezing temperatures.
3. Laminate construction shall be highly puncture and tear resistant and flame retardant. Product shall be suitable for application between -10°F and 248°F. Product shall be suitable for use at temperatures up to 300°F.
4. All joints shall be sealed with manufacturer's recommended joint tape.
5. Provide in silver or natural aluminum color finish.
6. Product shall carry a ten-year warranty. PART 3 - EXECUTION

2.6 INSPECTION:

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

2.7 PLUMBING PIPING SYSTEM INSULATION:

- A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, and pre-insulated equipment.
- B. Hot and Cold Piping:
 1. Application Requirements: Insulate the following hot and cold plumbing piping systems:
 - a. Potable cold-water piping
 - b. Potable hot water piping
 - c. Interior above-ground horizontal storm water piping from roof head to first vertical drop.
 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Flexible Unicellular:
 - 1) Tubing type for cold water and hot water – use [Specifier—edit insulation thickness as required to meet energy code.] for pipe sizes through 1-1/4", use [Specifier—edit insulation thickness as required to meet energy code.] for sizes 1-1/2" and above.
 - 2) Sheet type for storm roof drain bowls and sump pans -_use [Specifier—edit insulation thickness as required to meet energy code.]

2.8 HVAC PIPING SYSTEM INSULATION:

- A. Insulation Omitted: Omit insulation on cold piping within unit cabinets provided piping is located over drain pan; and on unions, flexible connections, and expansion joints.
- B. Cold Piping (40 degrees F to ambient):
 1. Application Requirements: Insulate the following cold HVAC piping systems:
 - a. Air conditioning unit condensate drain piping
 - b. Refrigeration suction lines between evaporators and compressors

- c. Discharge lines from cooling coil condensate pumps
- 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Flexible Unicellular:
 - 1) Use [Specifier—edit insulation thickness as required to meet energy code.] on all cooling condensate piping.
 - 2) On refrigerant suction lines only, use [Specifier—edit insulation thickness as required to meet energy code.] for pipes sizes up to and including 6".

2.9 DUCTWORK SYSTEM INSULATION:

- A. Insulation Omitted: Do not insulate indoor lined ductwork except as otherwise noted below.
- B. The specifications below apply when ductwork is round or unlined rectangular. See ductwork Specification Sections for ductwork to be lined.
- C. HVAC Ductwork (Supply and Return):
 - 1. Application Requirements: Insulate the following conditioned air ductwork:
 - a. Supply ductwork between HVAC unit discharge and room terminal outlets.
 - b. Return ductwork between HVAC unit intake and ceiling plenum.
 - c. Omit insulation on return air ductwork located in return air ceiling plenums or where exposed in a conditioned area.
 - 2. Insulate each ductwork system specified above with the following type and thickness of insulation:
 - a. Rigid Fiberglass: use [Specifier—edit insulation thickness as required to meet energy code.] in Equipment Rooms and where ductwork is exposed.
 - b. Flexible Fiberglass: use [Specifier—edit insulation thickness as required to meet energy code.], application limited to concealed locations

2.10 EQUIPMENT INSULATION:

- A. Cold Equipment (Below Ambient Temperature):
 - 1. Application requirements: Insulate the following cold equipment:
 - a. Pneumatic water tanks (If not factory insulated)
 - b. Roof drain bodies
 - 2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
 - a. Flexible Unicellular:
 - 1) For roof drain bodies only, use [Specifier—edit insulation thickness as required to meet energy code.].

2.11 INSTALLATION OF PIPING INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe system subsequent to installation of painting, testing, and acceptance of tests.

- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor barrier jackets on pipe insulation and protect to prevent puncture or other damage. Repair all punctures with ASJ tape designed for duty.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.
- I. Insulation Shields and Protection Saddles: Provide insulation shields and 20# density fiberglass blocking at each hanger site, providing shield gauges and blocking thicknesses shown. Cut and shape insulation to fit around protection saddles on steam and hot water piping. Saddles to be furnished and installed by piping trade.

2.12 INSTALLATION OF DUCTWORK INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation and protect it to prevent puncture and other damage. Repair all puncture sites with FSK tape designed for the duty.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or linings have been installed.

2.13 INSTALLATION OF EQUIPMENT INSULATION:

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Do not apply insulation to equipment, breechings, or stacks while hot.
- E. Apply insulation using staggered joint method for both single- and double-layer construction, where feasible. Apply each layer of insulation separately.
- F. Do not insulate ASME stamp and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

- G. Provide removable insulation sections to cover part of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

2.14 EXTERIOR DUCTWORK, PIPING AND EQUIPMENT

- A. Piping exposed to Weather: Piping shall be insulated as specified for interior piping.
 - 1. All duct, piping and equipment insulation shall be covered with five-ply foil/film covering as herein specified. Covering adhesive, and joint tape shall be installed as recommended by the covering manufacturer.

2.15 PROTECTION AND REPLACEMENT:

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damaged and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 15250

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SECTION 15411 - DOMESTIC WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 GENERAL:

- A. All pipe, fittings, and pipe joining material used for potable water systems shall be lead free in accordance with state and federal regulations.

1.2 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specifications Sections and other Division-15 Specification Sections apply to work of this Section.

1.3 SUMMARY:

- A. This Section specifies the water distribution piping system, including potable cold, hot, and recirculated hot water piping, fittings, and specialties within the building to a point 5 feet outside the building.
- B. Products installed but not furnished under this Section include water meters which will be provided by the Utility Company, to the site, ready for installation.

1.4 RELATED SECTIONS:

- A. The following Sections contain requirements that relate to this Section.
 - 1. Division-2 sections water service piping for trenching and backfilling materials and methods for underground piping installations.
 - 2. Division-7 Section "Joint Sealers" for materials and methods for sealing pipe penetrations through basement walls and fire and smoke barriers.
 - 3. Division 15 Section "Gages" for thermometers, flow meters, and pressure gages.
 - 4. Division-15 Section "Mechanical Identification" for labeling and identification of piping system.

1.5 DEFINITIONS:

- A. Water Distribution Piping: A pipe within the building, or on the premises, which conveys water from the water service pipe, or meter, to the points of usage.
- B. Water Service Piping: The pipe from the water main, or other source of potable water supply, to the water distributing system of the building served.
- C. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

1.6 SUBMITTALS:

- A. Product data for each piping specialty and valve specified.
- B. Maintenance data for each piping specialty and valve specified for inclusion in Maintenance Manual specified in Division-1 and Division-15 "Basic Mechanical Requirements."
- C. Welder's certificates certifying that welders comply with requirements specified in Quality Assurance below.
- D. Certification of Compliance with ASME and UL fabrication requirements specified below.
- E. Test reports specified in Part 3 of this Section.

1.7 QUALITY ASSURANCE:

- A. Regulatory Requirements: Comply with the provisions of the following:

1. ASME B 31.9 "Building Services Piping" for, materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
 2. ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualification" for Qualifications for Welding Processes and Operators
 3. Georgia Plumbing Code.
- 1.8 DELIVERY, STORAGE, AND HANDLING:
- A. Store pipe in a manner to prevent sagging and bending.
- 1.9 SEQUENCING AND SCHEDULING:
- A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad. Concrete reinforcement, and formwork requirements are specified in Division-3.
- B. Coordinate the installation of pipe sleeves for foundation wall penetrations.
- 1.10 EXTRA STOCK:
- A. Maintenance Stock: Furnish one valve key for each key operated hydrant, bibb, or faucet installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basket Strainers:
1. Josam Mfg. Co.
 2. Metraflex Co.
 3. Mueller
 4. Spirax Sarco
 5. Smith (Jay R.) Mfg. Co.
- C. Bibbs and Faucets:
1. Chicago Faucet Co.
 2. Hammond Valve Corp.
 3. Lee Brothers: Div. Phelps Dodge Brass Co.
 4. Mansfield Plumbing Products
 5. Nibco Inc.
 6. Watts Regulator Co.
- D. Hydrants:
1. Josam Mfg. Co.
 2. Jay R. Smith Mfg. Co.
 3. Wade/Tyler Pipe; Sub. of Tyler Corp.
 4. Watts Drainage Products
 5. Woodford Mfg. Co.
 6. Zurn Industries Inc., Hydromechanics Div.
- E. Backflow Preventers:

1. Febco Sales, Inc.: Subs. of Charles M. Bailey Co., Inc.
 2. Hersey Products, Inc.
 3. ITT Lawler; Fluid Handling Div.
 4. Watts Regulator Co.
 5. Zurn Industries, Inc.; Wilkins-Regulator Div.
- F. Vacuum Breakers
1. Watts Regulator Co.
 2. Febco Sales, Inc.; Subs. of Charles M. Bailey Co., Inc.
 3. Zurn Industries, Inc.; Wilkins-Regulator Div.
- G. Pressure Regulating Valves:
1. Cash (A. W.) Valve Mfg. Corp.
 2. Cla-Val Co.
 3. Spence Engineering Co., Inc.
 4. Watts Regulator Co.
- H. Relief Valves:
1. Cash (A. W.) Valve Mfg. Corp.
 2. Conbraco Industries, Inc.
 3. Watts Regulator Co.
 4. Zurn Industries, Inc.; Wilkins-Regulator Div.
- I. Water Hammer Arresters:
1. Amtrol, Inc.
 2. Josam Manufacturing Co.
 3. Jay R. Smith Mfg. Co.
 4. Wade/Tyler Pipe; Sub. of Tyler Corp.
 5. Watts Drainage Products
 6. Zurn Industries, Inc.
- J. Dielectric Unions:
1. Perfection Corp.
 2. Watts Regulator Co.
- K. Y-Pattern Strainers:
1. Armstrong Machine Works
 2. Hoffman Specialty ITT: Fluid Handling Div.
 3. Metraflex Co.
 4. Mueller
 5. Spirax Sarco
 6. Watts Regulator Co.

2.2 PIPE AND TUBE MATERIALS:

- A. General: Refer to Part 3, Article Applications, for identification of systems where the below materials are used.
- B. Drawn tempered copper tubing: ASTM B88, Type L
- C. Annealed tempered copper tubing: ASTM B88, Type K
- D. Steel pipe: ASTM A120, schedule 40, seamless, galvanized, cut groove ends.
- E. Ductile iron pipe: ANSI A21.51 ductile iron pipe, with ANSI A21.4 cement mortar lining.
- F. Evaporative cooling system:
 - 1. CPVC Plastic Pipe: ASTM D2846, Chlorinated Polyvinyl Chloride (CPVC) schedule 40, pipe and socket-type fittings with compatible solvent cement.
 - 2. PVC Plastic Pipe: AWWA C900, Class 100 Polyvinyl Chloride (PVC) water pipe, with socket-type fittings and compatible solvent cement

2.3 FITTINGS:

- A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.
- B. Galvanized Cast-iron Threaded Fittings: ANSI B16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.
- C. Ductile-iron Gasketed Fittings: AWWA C110, Schedule 150, with cement mortar lining and AWWA C111 rubber gaskets.
- D. Cast-iron Threaded Flanges: ANSI B16.1, Class 125; raised ground face, bolt holes spot faced.
- E. Cast Bronze Flanges: ANSI B16.24, Class 150; raised ground face, bolt holes spot faced.
- F. Evaporative cooling system:
 - 1. CPVC Plastic Fittings: ASTM D 2846, Chlorinated Polyvinyl Chloride (CPVC) socket-type fittings and solvent for solvent cemented joints.

2.4 UNIONS AND CONNECTORS:

- A. Unions: ANSI B16.39, malleable iron, Class 150, hexagonal stock, with ball- and- socket joints, metal-to-metal bronze seating surfaces; female threaded ends. Threads shall conform to ANSI B1.20.1.
- B. Dielectric Unions: Threaded or soldered end connections as required to suit application; constructed to isolate copper from galvanized pipe, prevent galvanic action, and prevent corrosion.
- C. Flexible Connectors: Stainless steel bellows with woven flexible bronze wire reinforcing protective jacket; minimum 150-psig working pressure, maximum 250° F operating temperature. Connectors shall have flanged or threaded end connections to match equipment connected; and shall be capable of 3/4-inch misalignment.

2.5 JOINING MATERIALS:

- A. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony.
 - 1. J.W. Harris "Stay-safe 50" or equal 94.5% Tin - 0.5% Silver 3% Antimony - 1.5% Zinc 0.5% Copper.
- B. Brazing Filler Metals: AWS A5.8, BCup-4 6% silver for joints below ground.
- C. Optional - Copper Pipe 2 1/2" and larger; (TIG) Gas Tungsten arc welding.
- D. Gasket Material: Thickness, material, and type suitable for fluid to be handled, and design temperatures and pressures.

2.6 GENERAL DUTY VALVES:

- A. Valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division-15 Section "Valves". Special duty valves are specified below by their generic name; refer to Part 3 Article "VALVE APPLICATION" for specific uses and applications for each valve specified.

2.7 PIPING SPECIALTIES:

- A. Water Hammer Arresters: Water hammer arresters shall be sized, tested and certified in accordance with PDI Standard WH-201, A.S.S.E.-1010 and A.N.S.I.- A112.26.1.
 - 1. Constructed of all stainless steel and with internal heavy duty balanced expansion bellows, pre-charged suitable for operation in temperature range of minus 100 to 300 degrees F and maximum 250-psig working pressure.
- B. Basket Strainers: Cast-iron body, 125 psi flanges, bolted type or yoke type cover; with removable non-corrosive perforated strainer basket having 1/8-inch perforations and lift-out handle.

2.8 HOSE BIBBS AND HYDRANTS:

- A. Hose Bibbs (HB-1): 304 stainless steel faceplate, anti-siphon, automatic draining wall hydrant for interior wall installation, integral backflow preventer, all bronze interior parts, 3/4" male hose connection, with key. Equal to Zurn Z1333-C
- B. Recessed Non-freeze Wall Hydrants (WH-1): Cast-bronze box, with nickel bronze face, tee handle key, vacuum breaker, hinged locking cover, 3/4-inch inlet, and hose outlet. Bronze casing shall be length to suit wall thickness. Equal to J.R.Smith model 5509 QT.

2.9 BACKFLOW PREVENTERS:

- A. Backflow Preventers: Reduced pressure zone principle assembly consisting of shutoff valves on inlet and outlet, and strainer on inlet. Assemblies shall include test cocks, and pressure differential relief valve located between 2 positive seating check valves and comply with requirements of ASSE Standard 1013. Unit must be listed by name and model number on the State Department of Health approved list of RPZ type valves.
- B. Pressure Type Vacuum Breaker: Watts No. 800 QT pressure type vacuum breaker certified under FCCCHR of USC Section 10, ASSE Std. 1020. Unit must be listed on the State Department of Health approved list of "Pressure Type Vacuum Breakers."

2.10 REGULATING AND RELIEF VALVES:

- A. Pressure Regulating Valves: Single seated, direct operated type: having bronze body with integral strainer and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.
- B. Relief Valves: Provide proper size relief valve, in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.
- C. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 °F, and pressure relief at 150-psig.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.

- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PIPE APPLICATIONS:

- A. Install Type L, drawn copper tubing with wrought copper fittings and solder joints for 4 inch and smaller above ground, within building. At the contractor's option, install Type L, drawn copper tubing with wrought copper press fittings in accordance with the manufacturer's recommendations for 2 inch and smaller above ground within building.
- B. Install Type K, annealed temper copper tubing for 2 inch and smaller with minimum number of joints, below ground and within slabs.
- C. Install steel pipe with threaded joints and fittings for all sizes larger than 4" above ground, within building. Install cement-lined ductile-iron pipe with rubber gasketed joints below ground, inside and outside the building.

3.3 PIPING INSTALLATION:

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
- B. Use fittings for all changes in direction and all branch connections.
- C. Branch connections shall be made from the side or bottom of the main to facilitate drainage.
- D. Install exposed piping, at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- E. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- F. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- G. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building.
- H. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- I. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- J. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple and cap.
- K. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6-inch shall be steel: pipe sleeves 6 inch and larger shall be sheet metal.
- L. Fire Barrier Penetrations: Where pipes pass through time rated fire restive construction including fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division-7 for special sealers and materials.
- M. Install piping level with no pitch.

3.4 HANGERS AND SUPPORTS:

- A. General: Hanger, supports, and anchors devices are specified in Division-15 Section 15140 "SUPPORTS AND ANCHORS." Conform to the table below for maximum spacing of supports:
- B. Install the following pipe attachments

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
- C. Install hangers with the following minimum rod sizes and maximum spacing: Nom. Pipe Size Max. Span-Ft Min. Rod Size-Inches

1 and smaller	7	3/8
1-1/4 and 1-1/2	9	3/8
2	10	3/8
3	12	1/2
3-1/2	13	1/2
4	14	5/8
5	16	5/8
6	17	3/4
8	19	7/8
10	22	7/8
12	23	7/8

Support vertical runs at each floor.

3.5 PIPE AND TUBE JOINT CONSTRUCTION:

- A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."
1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering.
 2. Heat joints to proper and uniform temperature.
- B. Threaded Joints: Conform to ANSI B1.20. 1, tapered pipe threads for field cut threads. Join pipe fittings and valves as follows:
1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 2. Align threads at point of assembly.
 3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
 4. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
 5. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- C. Flanged Joints: Align flanged surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible.
1. Use suitable lubricants on bolt threads.
 2. Tighten bolts gradually and uniformly using torque wrench.

3.6 SERVICE ENTRANCE:

- A. Extend water distribution piping to connect to water service piping of size and in location indicated for service entrance to building. Water service piping is specified in a separate Section of Division-2.
- B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.
- C. Install shutoff valve at service entrance inside building, complete with strainer, pressure gage, and test tee with valve.

D. Ductile-iron Pipe: Install in accordance with AWWA C-60.

3.7 INSTALLATION OF WATER METER:

- A. Install water meter in accordance with Utility Company's installation instructions and requirements.
- B. Set meter on concrete pad as indicated. Refer to Division-3 for concrete, formwork, and reinforcing requirements.
- C. Mount meter on wall brackets as indicated.

3.8 VALVE APPLICATIONS:

- A. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:
- B. Shut-off duty: Use gate, ball, and butterfly valves.
- C. Throttling duty: Use ball, and butterfly valves.

3.9 INSTALLATION OF VALVES:

- A. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2 inch and smaller, use gate or ball valves; for sectional valves 2-1/2 inch and larger, use gate or butterfly valves.
- B. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2 inch and smaller, use gate or ball valves; for shutoff valves 2-1/2 inch and larger, use gate or butterfly valves.
- D. Drain Valves: Install drain valves on each plumbing equipment item, located to completely drain equipment for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to completely drain distribution piping system. For drain valves 2 inch and smaller, use gate or ball valves; for drain valves 2-1/2 inch and larger, use gate or butterfly valves.
- E. Check Valves: Install swing check valves on discharge side of each pump, and elsewhere as indicated.
- F. Hose Bibbs, Sill Faucets: Install where indicated, with vacuum breaker.

3.10 INSTALLATION OF PIPING SPECIALTIES:

- A. Install backflow preventers at each connection to mechanical equipment and systems, and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Pipe relief outlet without valves, to nearest floor drain.
- B. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gage on valve outlet.
- C. Size and Locate Water Hammer Arresters in accordance with the following schedule and located within an effective range of the quick-closing valve as per the requirements of Standard PDI-WH201 current edition, whether shown or not shown on the drawings.

WATER HAMMER ARRESTER SCHEDULE

MARK	I.P.S.	F.U. RATING	J.R. SMITH NO.	WADE NO.	ZURN NO.
'A'	3/4"	1-11	5005	W-5	100
'B'	1"	12-32	5010	W-10	200
'C'	1"	33-60	5020	W20	300

'D'	1"	61-113	5030	W-50	400
'E'	1"	114-154	5040	W-75	500
'F'	1"	155-330	5050	W-100	600

All water hammer arresters shall be P.D.I. certified.

3.11 EQUIPMENT CONNECTIONS:

- A. Supplies and Trim: All supplies, hardware, trim, traps, etc. to fixtures and equipment shall be chrome plated brass if exposed.
- B. Piping Runouts to Fixtures: Provide hot and cold-water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.
- C. Mechanical Equipment Connections: Connect hot and cold-water piping system to mechanical equipment as indicated. Provide shutoff valve and union for each connection. Provide drain valve on drain connection. For connections 2-1/2" and larger, use flanges instead of unions.

3.12 FIELD QUALITY CONTROL:

- A. Inspections: Inspect water distribution piping as follows:
 - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the process of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - 3. Rough-in Inspection: Arrange for inspection of the piping system before being concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - 4. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
 - 5. Reinspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.
 - 6. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Test water distribution piping as follows:
 - 1. Test for leaks and defects all new water distribution piping systems and parts of existing systems which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
 - 3. Cap and subject the piping system to a static water pressure of 50-psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
 - 4. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
 - 5. Prepare reports for all tests and required corrective action.

3.13 ADJUSTING AND CLEANING:

- A. Clean and Disinfect water distribution piping as follows:
- B. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
- C. Hot water piping shall be sterilized with cold water, not heated.
- D. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA D105. or as described below:
 - 1. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
 - 2. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.
 - 3. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
 - 4. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.
 - 5. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.
- E. Prepare reports for all purging and disinfecting activities.
- F. The Contractor shall be solely responsible for the final delivery of potable water approved by the Department of Health.

3.14 COMMISSIONING:

- A. Fill the system.
- B. Check compression tanks to determine that they are not air bound and that the system is completely full of water.
- C. Before operating the system perform these steps:
- D. Open valves to fully open position. Close drain valves, hydrants, and sill cocks.
- E. Remove and clean strainers.
- F. Check pump for proper direction of rotation. Correct improper wiring.
- G. Lubricate pump motors and bearings.

END OF SECTION 15411

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SECTION 15420 - DRAINAGE AND VENT SYSTEMS

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 RELATED SECTIONS:

- A. The following Sections contain requirements that relate to this Section.
 - 1. Division 2 sections for trenching and backfilling materials and methods for underground piping installations.
 - 2. Division-7 Section "Joint Sealers" for materials and methods for sealing pipe penetrations through basement walls and fire and smoke barriers.
 - 3. Division-15 Section "Mechanical Identification" for labeling and identification of piping system.

1.3 SUBMITTALS:

- A. Product data for the following products:
 - 1. Drainage piping specialties
 - 2. Drainage pipe and fittings
 - 3. Floor drains
 - 4. Roof drains
- B. Maintenance data for each piping specialty specified for inclusion in Maintenance Manual specified in Division-1 and Division-15 "Basic Mechanical Requirements."
- C. Inspection reports specified in Part 3 of this Section.
- D. Test reports specified in Part 3 of this Section.

1.4 QUALITY ASSURANCE:

- A. Regulatory Requirements: Comply with the provisions of the following:
 - 1. Georgia Plumbing Code

1.5 SEQUENCING AND SCHEDULING:

- A. Coordinate the installation of roof drains, flashing, and roof penetrations.
- B. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.
- C. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems components from one of the following:
 - 1. Drainage Piping Specialties.
 - a. Jay R. Smith Mfg. Co.
 - b. Josam Mfg. Co.

- c. Wade/Tyler Pipe; Subs. of Tyler Corp.
 - d. Watts Drainage Products
 - e. Zurn Industries Inc.; Hydromechanics Div.
- 2. Floor drains:
 - a. ACO Drain
 - b. Polycast
 - c. Polydrain
 - d. Jay R. Smith Co.
 - e. Josam Mfg. Co.
 - f. Wade/Tyler Pipe; Subs. of Tyler Corp.
 - g. Watts Drainage Products
 - h. Zurn Industries, Inc.
- 3. Roof Drains:
 - a. Jay R. Smith Co.
 - b. Josam Mfg. Co.
 - c. Wade/Tyler Pipe; Subs. of Tyler Corp.
 - d. Watts Drainage Products
 - e. Zurn Industries, Inc.

2.2 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS:

- A. Hubless Cast-Iron Soil Pipe: CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310, and heavy duty coupling. Couplings shall be constructed of 304 stainless steel. Coupling sizes through 4" shall have 4 bands and sizes over 4" shall have 6 bands.
- B. Pipe Size 2" and Smaller: Galvanized steel pipe, Schedule 40, ASTM A53; cast-iron screw joint drainage pattern fittings.
- C. Pipe Size 2" and Smaller: copper D.W.V., ASTM B306. (NOT TO BE USED ON URINAL WASTE).
- D. PVC, Type DWV Pipe And Fittings: ASTM D2665 pipe and fittings, with solvent cemented joints; DWV plastic fitting patterns shall conform to ASTM D2464.
 - 1. Solvent: ASTM D2564

2.3 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS:

- A. Cast-Iron Soil Pipe: CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310.
 - 1. Neoprene Compression Gaskets: ASTM C564.
- B. Hubless Cast-Iron Soil Pipe: CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310, and heavy duty coupling. Couplings shall be constructed of 304 stainless steel. Coupling sizes through 4" shall have 4 bands and sizes over 4" shall have 6 bands.
- C. PVC Sewer Pipe and Fittings: Conform to ASTM D2665 for pipe and fittings.
 - 1. Solvent: ASTM D2564.

2.4 FORCE MAIN PIPING:

- A. Pipe Size 2" and Larger: PVC ASTM-D-2241 SDR 26, ASTM-D-1785, watrous grade pressure pipe.
- B. Solvent-weld (cement) fittings are acceptable above and below ground. (On 4" and larger joints, mechanical clamping devices are required to seat and hold elements, while solvent cures.)

2.5 DRAINAGE PIPING SPECIALTIES:

- A. Backwater Valves: Valve assembly shall be bronze fitted cast-iron, with bolted cover. Flapper shall provide a maximum 1/4 inch clearance between flapper and seat for air circulation. Valve ends shall suit piping material.
- B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.
- C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.
- D. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.
- E. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.
- F. Cleanouts
 - 1. Floor Cleanouts: Cast-iron body and frames or combination cast-iron/ABS body and frame; brass cleanout plug; nickel-bronze adjustable round top. Manufacturer's standard cast unit of pattern indicated as follows:
 - a. Pattern: Exposed flush type, standard non-slip scoriated finish; Jay R. Smith 4023. Nickel Bronze Round top.
 - b. Pattern: In carpeted areas, Polished Bronze flush type, standard non-slip scoriated finish, stainless steel carpet marker; Jay R. Smith 4023Y.
 - c. Pattern: In tile, Nickel Bronze, flush type, standard non-slip scoriated finish; Jay R. Smith 4143, round top.
 - d. In open warehouse areas subject to fork truck traffic, standard non-slip scoriated finish; heavy-duty, cast-iron round top; Jay R. Smith Fig. 4223.
 - 2. Wall Cleanouts: Duco cast iron caulk ferrule with cast bronze taper threaded plug nickel bronze frame and polished bronze secured cover flush with wall like Jay R. Smith model 4435.
- G. Floor drains:
 - 1. General: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein.
 - 2. Floor drain Type "FD-1": Cast-iron body and flashing collar, nickel bronze round adjustable strainer head with secured square hole grate and deep seal P-trap, auxiliary trap primer inlet; Jay R. Smith 2005A.
 - 3. Floor drain Type "FD-2": Cast-iron body and flashing collar, nickel bronze square adjustable strainer head with secured square hole grate and deep seal P-trap, auxiliary trap primer inlet; Jay R. Smith 2005A.
 - 4. Floor Sink Type "FD-3": Floor sink cast-iron flanged receptor with acid resistant coated interior and nickel bronze rim and two half grates, aluminum sediment bucket; Jay R. Smith 3161-12 and 4595 P-trap with 4023 floor cleanout.

H. Roof Drains

1. Roof Drain Type RD: Cast iron body with sump; combination flashing clamp and gravel stop; twist lock, cast iron dome; under deck clamp; No-hub connection; sump receiver; Jay R. Smith 1010-Y-C-R-CID.
2. Roof Drain Type ODR: Overflow drain; Cast iron body with sump; combination flashing clamp and gravel stop; 2" water dam; twist lock, cast iron dome; under deck clamp; No-hub connection; sump receiver; Jay R. Smith 1080-Y-C-R-CID.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- C. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION FOUNDATION FOR UNDERGROUND BUILDING DRAINS:

- A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.
- B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.
- C. Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 PIPE APPLICATIONS – SANITARY DRAIN AND VENT PIPING ABOVE GROUND, WITHIN BUILDING:

- A. Optional – hub-less, service weight, cast-iron soil pipe and fittings for drainage and vent pipe.
- B. Optional - PVC Type DWV Plastic pipe and fittings for drainage and vent pipe. **PVC piping shall not be installed in return air plenums.** Verify location with HVAC plans.

3.4 PIPE APPLICATIONS - SANITARY DRAIN AND VENT PIPING BELOW GROUND, WITHIN BUILDING:

- A. Optional - hub-and-spigot, service- weight, cast-iron, soil pipe and fittings with gasketed joints for drainage pipe.
- B. Optional - PVC sewer pipe and fittings with solvent cemented joints for drainage pipe.

3.5 PIPE APPLICATIONS – STORM DRAIN PIPING ABOVE GROUND, WITHIN BUILDING:

- A. Optional - hubless, service weight, cast-iron soil pipe and fittings for drainage and vent pipe.
- B. Optional - PVC Type DWV Plastic pipe and fittings drainage and vent pipe. **PVC piping shall not be installed in return air plenums.** Verify location with HVAC plans.

3.6 PIPE APPLICATIONS - STORM DRAIN PIPING BELOW GROUND, WITHIN BUILDING:

- A. Optional - hub-and-spigot, service- weight, cast-iron, soil pipe and fittings with gasketed joints for drainage pipe.

- B. Optional - PVC sewer pipe and fittings with solvent cemented joints for drainage pipe.

3.7 PIPE AND TUBE JOINT CONSTRUCTION:

- A. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.
- B. ABS DWV Pipe: Joining and installation of ABS drainage pipe and fittings shall conform to ASTM D2661.
- C. PVC DWV Pipe: Joining and installation of PVC drainage pipe and fittings shall conform to ASTM D2665.
- D. ABS and PVC Sewer Pipe: Installation of underground ABS sewer pipe shall conform to ASTM D2321.
- E. ABS to PVC Transition Joints: When joining ABS to PVC components (such as an ABS building drain to PVC sewer pipe) make joints using solvent cements conforming to ASTM D3138.

3.8 INSTALLATION:

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.
- B. Use fittings for all changes in direction and all branch connections.
- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.
- G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.
- H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials. All piping penetrations through fire rated walls shall be cast iron.
- I. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- J. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in

accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

- K. Install building drain pitched down at minimum slope of 1/4 inch per foot (2 percent) for piping 3 inch and smaller, and 1/8 inch per foot (1 percent) for piping larger than 3" unless otherwise noted on the Drawings.
- L. Extend building drain to connect to sewer piping, of size and in location indicated for service entrance to building. Sewer piping is specified in a separate section of Division 2.
- M. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.

3.9 HANGERS AND SUPPORTS:

- A. General: Hanger, supports, and anchors devices are specified in Division 15 Section "Basic Mechanical Materials and Methods." Conform to the table below for maximum spacing of supports.
- B. Install the following pipe attachments:
- C. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
- D. Install hangers at the following intervals:

PIPE MATERIAL	MAX HORIZ SPACING	MAX VERT SPACING
Cast-Iron Pipe	5	15
Copper Tubing - 1-1/4" and smaller	6	10
Copper Tubing - 1-1/2" and larger	10	10
PVC Pipe	4	4

3.10 INSTALLATION OF PIPING SPECIALTIES:

- A. Install backwater valves in sanitary building drain piping as indicated, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.
- B. Install expansion joints on vertical risers as indicated, and as required by the plumbing code.
- C. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
 - 1. As required by plumbing code;
 - 2. At each change in direction of piping greater than 45 degrees;
 - 3. At minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
 - 4. At base of each vertical soil or waste stack.
- D. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.
- E. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.
- F. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.11 INSTALLATION OF FLOOR DRAINS:

- A. General: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Coordinate flashing work with work of waterproofing and adjoining substrate work.
- C. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- D. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring.
- E. Maintain integrity of waterproof membranes, where penetrated.
- F. Position drains so that they are accessible and easy to maintain.
- G. Waterproof each floor drain above ground by providing a 16-inch x 16-inch flashing constructed in place using 40 mil chlorinated polyethylene sheets (Chloraloy 240). Install using manufacturers recommended procedure and in accordance with the Plumbing Code. Installation of flashing shall be coordinated with the floor construction.

3.12 CONNECTIONS:

- A. Piping Run outs to Fixtures: Provide drainage and vent piping run outs to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.
- B. Locate piping run outs as close as possible to bottom of floor slab supporting fixtures or drains.

3.13 FIELD QUALITY CONTROL:

- A. Inspections
 - 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
 - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
 - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
 - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
 - 3. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.
 - 4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Piping System Test drainage and vent system as follows:
 - 1. Test for leaks and defects in all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
 - 2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.

3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for all tests and required corrective action.

3.14 ADJUSTING AND CLEANING:

- A. Clean interior of piping system. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.15 PROTECTION:

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
- C. Exposed ABS or PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of a water-based latex paint.

END OF SECTION 15420

SECTION 15440- PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specifications Sections and other Division-15 Specification Sections, apply to work of this Section. Refer to Section 15010, "Basic Mechanical Requirements" for additional requirements.
- B. The requirements of the following Division-15 Sections apply to this Section:
 - 1. "Basic Mechanical Requirements"
 - 2. "Basic Mechanical Materials and Methods"
 - 3. "Supports and Anchors"
- C. Separate grab bar and toilet accessories not an integral part of plumbing fixtures are specified in Division 10.

1.2 DESCRIPTION OF WORK:

- A. Extent of plumbing fixtures work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. Types of plumbing fixtures specified in this Section include the following:
 - 1. Water closets
 - 2. Urinals
 - 3. Lavatories (including barrier free type)
 - 4. Water coolers (including barrier free type)
 - 5. Stainless steel sinks
 - 6. Mop basins
 - 7. Wash fountains
 - 8. Vending Machine Supply Boxes
- C. Refer to Division-16 Sections for field-installed electrical wiring required for water coolers and other plumbing fixtures; not work of this Section.

1.3 QUALITY ASSURANCE:

- A. Plumbing Fixture Standards: Comply with applicable portions of the Illinois State Plumbing Code with the City of Rockford Amendments, herein referred to as the Plumbing Code.
- B. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems, and bath tub units including the following:
 - 1. ANSI A112.6.1 – Supports for Off-the-Floor Plumbing Fixtures for Public Use.
 - 2. ANSI A112.18.1 – Plumbing Fixture Fittings.
 - 3. ANSI A112.19.2 – Vitreous China Plumbing Fixtures.
 - 4. ANSI Z358.1 – Emergency Eye Wash and Shower Equipment.
- C. PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.
- D. UL Compliance: Construct water coolers in accordance with UL Standard 399 "Drinking-Water Coolers," and provide UL-listing and label.

- E. ASHRAE Compliance: Test and rate water coolers in accordance with ASHRAE Standard 18 "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems."
- F. ARI Compliance: Construct and install water coolers in accordance with ARI Standard 1010 "Drinking-Fountains and Self-Contained Mechanically- Refrigerated Drinking-Water Coolers," and provide Certification Symbol.
- G. ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Specifications for making buildings and facilities accessible to and usable by physically handicapped people."
- H. ASSE Compliance: ASSE 1037 – Flushometers (Pressurized Flushing Devices)
- I. ADA Compliance: Construct and install barrier-free plumbing fixtures in accordance with Title III of the ADA of 1990 accessibility guidelines for buildings and facilities, and the State of Illinois ADA requirements.

1.4 SUBMITTALS:

- A. Product Data: Submit Manufacturer's Technical Product Data and installation instructions for each fixture, faucet, specialty, accessory, and trim specified; clearly indicate rated capacities of selected models of water coolers.
- B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in Division-6 for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.
- C. Maintenance Data: Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include this data and produce data in maintenance manual; in accordance with requirements of Division-1.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver plumbing fixtures, specialties, accessories, and trim individually wrapped in factory-fabricated containers.
- B. Handle plumbing fixtures specialties, accessories, and trim carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures specialties, accessories, or trim; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide trim and fittings including faucets, supplies, stops, traps, tailpieces, waste nipples, hangers, plates, brackets, anchors, supports, hardware, and fastening devices required for a complete installation.
- B. All vitreous china plumbing fixtures shall be furnished by the same manufacturer for each product specified throughout.
- C. All fixture trim shall be by same manufacturer for each product specified throughout.

2.2 MATERIALS:

- A. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.
- B. Where fixture trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

- C. Stainless Steel: ASTM A 167, Type 302/304, hardest workable temper, with No. 4 finish having, bright, directional polish on exposed surfaces.
- D. Vitreous China: High Quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.
- E. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.3 WALL OUTLET FLUSH VALVE WATER CLOSETS:

- A. Water Closet (WC-1), ADA compliant: 17" high, 1.6 GPF, white vitreous china wall outlet siphon jet elongated bowl with top spud.
 - 1. American Standard #2257.001, AFWall
 - 2. ASSE 1037-Sloan Regal Pro 111 (Zurn Aqua Vantage) exposed quiet- operating diaphragm type, chrome plated flushometer valve. Valve shall be non-hold-open with no external volume adjustment, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange.
 - a. Dual filtered type diaphragm kit.
 - b. ADA compliant handle. Offset valve to clear grab bar if needed.
 - 3. Olsonite 95 white solid plastic open front integral check seat less cover.
 - 4. Provide automatic trap primer to serve floor drain, 1 ½" x 12" 17 gauge flush valve primer tube with 3/8" compression fitting, w/ vacuum breaker. PPP model # FVP-1VB
- B. Water Closet (WC-2): 1.6 GPF, white vitreous china wall outlet siphon jet elongated bowl with top spud.
 - 1. American Standard #2257.001, AFWall
 - 2. ASSE 1037-Sloan Regal Pro 111 (Zurn Aqua Vantage) exposed quiet- operating diaphragm type, chrome plated flushometer valve. Valve shall be non-hold-open with no external volume adjustment, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange.
 - a. Dual filtered type diaphragm kit.
 - b. ADA compliant handle. Offset valve to clear grab bar if needed.
 - 3. Olsonite 95 white solid plastic open front integral check seat less cover.

2.4 FLOOR OUTLET FLUSH VALVE WATER CLOSETS:

- A. Water Closet (WC-3), ADA compliant: 17" high, 1.6 GPF, white vitreous china floor outlet siphon jet elongated bowl with top spud.
 - 1. American Standard 3043.102, Madera
 - 2. ASSE 1037-Sloan Regal Pro 111 (Zurn Aqua Vantage) exposed quiet- operating diaphragm type, chrome plated flushometer valve. Valve shall be non-hold-open with no external volume adjustment, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange.
 - a. Dual filtered type diaphragm kit.
 - b. ADA compliant handle. Offset valve to clear grab bar if needed.
 - 3. Olsonite 95 white solid plastic open front integral check seat less cover.

4. Provide automatic trap primer to serve floor drain, 1 1/2" x 12" 17 gauge flush valve primer tube with 3/8" compression fitting, w/ vacuum breaker. PPP model # FVP-1VB

2.5 WALL HUNG URINALS:

- A. Urinal (UR-1): 1.0 GPF, ADA Compliant; white vitreous china wall hung siphon jet flush action urinal with extended shields, 3/4" top spud, integral flush spreader and trap.
 1. American Standard 6561.017, Trimbrook.
 2. ASSE 1037-Sloan Regal Pro 186-1.0 (Zurn Aqua Vantage)) exposed quiet-operating diaphragm type, chrome plated flushometer valve. Valve shall be non-hold-open with no external volume adjustment, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange.
 - a. Dual filtered type diaphragm kit.
 - b. ADA compliant handle.
 3. J.R. Smith 636 floor mount support.
- B. Urinal (UR-2): 1.0 GPF, white vitreous china wall hung siphon jet flush action urinal with extended shields, 3/4" top spud, integral flush spreader and trap.
 1. American Standard 6561.017, Trimbrook.
 2. ASSE 1037-Sloan Regal Pro 186-1.0 (Zurn Aqua Vantage)) exposed quiet-operating diaphragm type, chrome plated flushometer valve. Valve shall be non-hold-open with no external volume adjustment, vacuum breaker with bottom hex coupling nut, screwdriver stop with (free spinning), vandal resistant stop cap and sweat solder adapter kit with cast set screw wall flange.
 - a. Dual filtered type diaphragm kit.
 - b. ADA compliant handle.
 3. J.R. Smith 636 floor mount support.

2.6 BARRIER FREE CHINA LAVATORIES:

- A. Lavatory (L-1): ADA Compliant; 20"x 18" white vitreous china high back basin for concealed arm bracket with open grid strainer and with faucet holes on 4" centers.
 1. American Standard 0355.012, Lucerne.
 2. Chicago 802A-E2805-317 0.5 G.P.M., vandal resistant, supply fitting with 4" wrist blade handles.
 3. Grid drain assembly with tailpiece.
 4. Adjustable two piece cast-brass P-trap with cleanout with escutcheon.
 5. 1/2" I.P.S. x 3/8" O.D. loose key angle stop supplies with flexible risers and 1/2" chrome plated nipples and escutcheons.
 6. J.R. Smith 700 floor mount concealed arm support.
 7. Install for barrier free use with insulated drain and water supplies.

2.7 SELF-RIMMING COUNTER INSERT BASINS:

- A. Lavatory (L-2) : ADA Compliant; 20" x 17" white vitreous china self-rim counter insert basin with faucet holes on 4" centers.
 1. American Standard 0476.028, Aqualyn; Kohler K2195 "Pennington".
 2. Chicago 802A-E2805-317 0.5 G.P.M., vandal resistant, supply fitting with 4" wrist blade handles.

3. Grid drain assembly.
4. Adjustable two piece cast-brass P-trap with cleanout with escutcheon.
5. 1/2" I.P.S. x 3/8" O.D. loose key angle stop supplies with flexible risers and 1/2" chrome plated nipples and escutcheons.
6. Insulated drain and water supplies.

2.8 BARRIER FREE STAINLESS STEEL LAVATORIES:

- A. Lavatory (L-3): ADA Compliant; 20"x 18" 16 ga type 304 stainless steel high back basin for concealed arm bracket with open grid strainer and with faucet holes on 4" centers.
 1. Oasis OH65-234.
 2. Chicago 802A-E2805-317 0.5 G.P.M., vandal resistant, supply fitting with 4" wrist blade handles.
 3. Grid drain assembly with tailpiece.
 4. Adjustable two piece cast-brass P-trap with cleanout with escutcheon.
 5. 1/2" I.P.S. x 3/8" O.D. loose key angle stop supplies with flexible risers and 1/2" chrome plated nipples and escutcheons.
 6. J.R. Smith 700 floor mount concealed arm support.
 7. Install for barrier free use with insulated drain and water supplies.

2.9 BI-LEVEL ELECTRIC WATER COOLERS:

- A. Electric Water Cooler (EWC-1): Oasis P8AMSL barrier free, bi-level, UL labeled, front push button self-contained electric water cooler with stainless steel top.
 1. Unit shall have steel mounting frame, nonferrous waterways, built-in pressure regulator, automatically operated permanently lubricated air-cooled hermetically sealed cooling unit with freeze-up protection, and adjustable temperature control.
 2. Electrical rating: 115 VAC, provide cord and plug.
 3. Minimum cooling capacity 8.0 GPH (80 degrees entering to 50 degrees drinking at 90 degrees ambient).
 4. Provide 17 gauge adjustable P-trap with cleanout plug with escutcheon; (Chicago 376), straightway stop with supply tubing.

2.10 WALL HUNG ELECTRIC WATER COOLERS:

- A. Electric Water Cooler (EWC-2): Oasis P8AC wall-hung, self-contained electric water cooler with front and side push pads, and stainless-steel top.
 1. Unit shall have nonferrous waterways, built-in pressure regulator, automatically operated permanently lubricated air-cooled hermetically sealed cooling unit with freeze-up protection, UL labeled, and adjustable temperature control.
 2. Electrical rating: 115 VAC, provide cord and plug.
 3. Minimum cooling capacity 8.0 GPH (80 degrees entering to 50 degrees drinking at 90 degrees ambient).
 4. Provide optional glass filler.

2.11 STAINLESS STEEL SINGLE COMPARTMENT SINKS:

- A. Single compartment sink (SK-1): 19" x 21" O.D. single compartment 18-gauge stainless steel self-rim counter insert three hole ledge sink with 7-1/2" deep bowl.
 1. JUST SL-1921-A-GR

2. Delta Model 3579 WF HDF 8" centerset with 4" wrist blade handles and rigid gooseneck.
3. Just J-35 standard duo strainer with tailpiece.
4. Provide 17-gauge adjustable P-trap with cleanout plug with escutcheon; 1/2" I.P.S. x 1/2" O.D. angle stop with supply tubing.

2.12 STAINLESS STEEL DOUBLE COMPARTMENT SINKS:

- A. Three compartment double drain board sink (SK-2): Fabricated of 14 gauge type 304, 18-8 stainless steel, seamless welded construction throughout, square corner compartments, bottoms pitched to drain. Drainboards to have minimum 1/8 inch radius bend formations and 1/4 inch inside radius fillet welds at corners. 1-1/2 inch roll rim on three sides, exposed surfaces polished to hand-blend Just finish, exterior surfaces to have a brush finish, supported on (4) 16 gauge 1-5/8 inches O.D. stainless steel tubular legs with fully enclosed gussets and adjustable bullet feet, standard height of 36 inches of roll rim from finished floor, 12 inch back. Certified to ANSI/NSF Standard 2.
 1. Sink; Just NSFB-345-24RL.
 2. Faucet, two required; Chicago Faucet CF2831H601LC, back splash wall mounted fill faucet, 8" center set polished chrome plated brass, L6 swing spout, E1-Quixtop outlet, 369 lever handles.
 3. Drain; Just J-35-BLA-2", twist handle drain with bronze body, stainless steel flat grid strainer, 2 inch O.D. tailpiece 4 inches long.

2.13 MOP BASINS:

- A. Mop Basin (MB-1): 36" x 24", molded stone receptor with brass drain body, stainless steel dome strainer-lint basket, vinyl bumper guard.
 1. E.L. Mustee and Sons, Inc., Model 65
 2. Chicago 897 supply fitting with integral stops, vacuum breaker, bucket hook, wall brace, and 3/4" hose thread on spout.
 3. 30" long heavy-duty cloth reinforced rubber hose with stainless steel hose bracket.
 4. Stainless steel mop hanger with three rubber tool grips, silicone sealant.
 5. Provide stainless steel splash panel on wall.

2.14 WASH FOUNTAINS:

- A. Wash fountain (WF-1): Bradley TDB3104-STD-IR-TMA-MLSD, 54" semi-circular solid surface "Terreon" wash fountain sensor operated, with thermostatic mixing valve, 4 station vandal-resistant spray nozzles, metal liquid soap dispenser, lather valve assembly: Smith 7202 one piece cast brass P-trap with cleanout; Chicago 375 straightway stop with supply tubing. Color to be "Lannonstone".
- B. Wash fountain (WF-2): Bradley TDB3108-STD-A-IR-TMA-MLSD, 54" circular solid surface "Terreon" wash fountain sensor operated, with thermostatic mixing valve, 4 station vandal-resistant spray nozzles, metal liquid soap dispenser, lather valve assembly: Smith 7202 one piece cast brass P-trap with cleanout; Chicago 375 straightway stop with supply tubing. Color to be "Lannonstone". Venting option "A" to be used to eliminate exposed vent piping.

2.15 VENDING MACHINE SUPPLY BOX:

- A. Vending Machine Supply Box (VM-1): Guy Gray BIM875 11 1/2" x 9 1/2" 20 gauge galvanized steel box with 1/2" FIP inlet X 1/4" OD outlet compression angle valve.

2.16 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide plumbing fixtures of one of the following:

- B. WATER CLOSETS, URINALS, AND LAVATORIES:
 - 1. American Standard
 - 2. Crane Co.
 - 3. Eljer
 - 4. Kohler Co.
- C. ELECTRIC WATER COOLERS:
 - 1. Oasis Water Coolers Ebco Mfg. Co.
 - 2. Elkay Mfg. Co.
 - 3. Halsey Taylor Div.; Household International Co.
 - 4. Haws Drinking Faucet Co.
- D. STAINLESS STEEL SINKS:
 - 1. American Standard: U.S. Plumbing Products
 - 2. Elkay Mfg. Co.
 - 3. Just Mfg. Co.
 - 4. Oasis
 - 5. AERO Mfg. Co.
 - 6. Advance Tabco.
- E. STOPS AND SUPPLY TUBING:
 - 1. American Standard
 - 2. Brass Craft
 - 3. Chicago Faucet Co.
 - 4. Eastman
 - 5. Kohler Co.
 - 6. McGuire
 - 7. T and S Brass and Bronze Works. Inc.
 - 8. Zurn Aqua-Spec
- F. FLUSH VALVES:
 - 1. Sloan Valve Co.
 - 2. Zurn Industries, Inc.: Hydro Mechanics Div.
- G. LAVATORY/SINK FAUCETS AND TRIM:
 - 1. American Standard
 - 2. Chicago Faucet Co.
 - 3. Cambridge Brass; Div. of Masco Corp.
 - 4. Delta Faucet Co; Div. of Masco Corp.
 - 5. Eljer Plumbing ware Div. Household International Co.
 - 6. Elkay Mfg. Co.
 - 7. Moen Group, Standyne Inc.
 - 8. Kohler Co.

9. Speakman
 10. T & S Brass and Bronze Works, Inc.
 11. Zurn Aqua-Spec
- H. LAVATORY/SINK P-TRAPS AND TAILPIECES:
1. American Standard
 2. Crane
 3. Dearborn
 4. Eljer
 5. Kohler Co.
 6. McGuire
 7. Sanitary-Dash
 8. Zurn Aqua-Spec
- I. ADA INSULATION KITS
1. True Bro
 2. SKAL – GARD
 3. Plumberex
- J. SERVICE SINK/MOP RECEPTOR FAUCETS AND TRIM:
1. Cambridge Brass; Div. of Masco Corp.
 2. Chicago Faucet Co.
 3. Fiat Products, Inc.
 4. E.L. Mustee and Sons, Inc.
 5. Speakman
 6. Zurn Aqua-Spec
- K. FIXTURE CARRIERS:
1. Ancon
 2. Josam Mg. Co.
 3. J.R.Smith Mfg. Co.
 4. Wade Div.
 5. Watts Drainage Products
 6. Zurn Industries, Inc.
- L. FIXTURE SEATS:
1. Bemis Mfg. Co.
 2. Beneke Corp.
 3. Church Products, Forbes-Wright Industries. Inc.
 4. Olsonite Corp,
 5. Sperzel Ind.
- M. FLOOR MOUNTED MOP RECEPTORS:
1. Creative Industries Terrazzo, Products, Inc.

2. Fiat Products, Inc.
 3. E.L. Mustee and Sons, Inc.
 4. Stern-Williams, Co., Inc.
 5. Swan Corp.
- N. WASH FOUNTAINS:
1. Acorn Engr. Co.
 2. Bradley Corp.
- O. VENDING MACHINE SUPPLY BOXES:
1. Guy Gray

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Installer of rough-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PLUMBING FIXTURES:

- A. General: Install plumbing fixtures of types indicated where shown and at indicated heights: in accordance with fixture manufacturer's written instructions, rough-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of The Americans with Disabilities Act of 1990, The Indiana Handicapped Code, ANSI A117.1 and The Plumbing Code pertaining to installation of plumbing fixtures.
- B. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.
- C. Protect installed fixtures from damage during remainder of construction period.
- D. Caulk around all wall or floor mounted fixtures using nonporous-bond silicone rubber mold/mildew resistant acid type sealant depositing a uniform continuous ribbon without gaps or air pockets, and with complete "wetting" of joint bond surfaces equally on opposite sides. Fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal and vertical surface, fill joints to form a slight cove, so that joint will not trap moisture and dirt.
- E. Flush Controls designated as "barrier free" which are hand operated or automatic shall comply with The Americans with Disabilities Act of 1990, Article 4.16.5 and
- F. 4.27.4. Controls for flush valves shall be mounted on the wide side of toilet areas no more than 44 inches above the floor to centerline of trip lever/push button for use by adults, and no more than 32" above the floor to centerline of trip lever/push-button for use by children in elementary schools.
- G. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

ROUGH-IN SCHEDULE

FIXTURE	HOT WATER	COLD WATER	WASTE	VENT	TRAP SIZE

Lavatory	1/2"	1/2"	1-1/4"	1-1/4"	1-1/4"
Sink	1/2"	1/2"	1-1/2"	1-1/2"	1-1/2"
Water Closet With FV		1"	4"	2"	
Urinals		3/4"	2"	1-1/2"	2"
Mop Basins	3/4"	3/4"	3"	1-1/2"	3"
Electric Water Cooler		1/2"	1-1/4"	1-1/4"	1-1/4"

MOUNTING HEIGHTS SCHEDULE:

FIXTURE	MOUNTING HEIGHT
Water Closet	15" floor to seat
Wheelchair Water Closet	18" floor to seat
Standard Urinals	24" floor to rim
Barrier free Urinals	17" floor to rim
Lavatory or Sink	31" floor to rim
Barrier free Lavatories	29" Min. Knee Clearance
Adult Standard Water Cooler	40" floor to rim
Barrier free Water Cooler	36" floor to bubbler

3.3 FIELD QUALITY CONTROL:

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance: otherwise, remove and replace with new units and proceed with retesting.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

3.4 ADJUSTING AND CLEANING:

- A. Clean plumbing fixtures, trim and strainers of dirt and debris upon completion of installation.
- B. Adjust water pressure at drinking fountains, faucets, and flush valves to provide proper flow stream and specified gpm.
- C. Adjust or replace washers to prevent leaks at faucets and stops.

3.5 EXTRA STOCK:

- A. General: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt. Furnish one device for every 10 units.

END OF SECTION 15440

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SECTION 15461 - ELECTRIC WATER HEATERS

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 DESCRIPTION OF WORK:

- A. Extent of water heater work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to other Division-15 sections for water piping, specialties, and pumps which are required external to water heaters for installation; not work of this section.
- C. Electrical Work: Refer to Division-15 section "Electrical Provisions of Mechanical Work" for requirements.
- D. Refer to Division-16 sections for other electrical wiring including motor starters, disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of water heaters of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. UL Compliance's: Construct water heaters in accordance with the following UL standards:
 - 2. UL 174, "Household Electric Storage-Tank Water Heaters".
- C. Provide water heater components which are UL-listed and labeled.
- D. NEC Compliance: Install electric water heaters in accordance with requirements of NFPA 70, "National Electrical Code".
- E. ASME Code Symbol Stamps: Provide water heaters and safety relief valves which comply with ASME Boiler and Pressure Vessel Code and are stamped with appropriate code symbols.
- F. ASHRAE Compliance: Provide water heaters with Performance Efficiencies not less than prescribed in ASHRAE 90A, "Energy Conservation in New building Design".

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data including rated capacities and efficiencies of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation and start-up instructions.
- B. Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, required clearances, and methods of assembly of components.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring to water heaters. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of water heaters and controls. Differentiate between portions of wiring that are factory-installed and portions that are to be field-installed.
- D. Maintenance Data: Submit maintenance data and parts listed for each type and size of water heater, control, and accessory; including "trouble-shooting" maintenance guide.

Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.

- E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Handle water heaters and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged water heaters or components; remove from site and replace with new.
- B. Store water heaters and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's rigging and installation instructions for unloading water heaters and moving units to final location for installation.

1.6 SPECIAL PROJECT WARRANTY:

- A. Warranty on Coil, Heat Exchanger, and Burner: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, coils, heat exchangers, and burners with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only and does not include labor for removal and reinstallation.

1. Warranty Period: 3 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ELECTRIC WATER HEATERS:

- A. General: Provide residential electric water heaters of sizes, capacities, and electrical characteristics as indicated on schedule.
- B. Heater: Construct for working pressure of 150 PSI; magnesium anode rod; glass lining on internal surfaces exposed to water.
- C. Heating Elements: Low watt density with zinc plated copper sheath; double element, non-simultaneous operation.
- D. Safety Controls: Equip with high temperature cutoff for each element, factory wired.
- E. Jacket: Equip with full size control compartments with front panel opening. Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish.
- F. Accessories: Provide brass drain valve; 3/4" relief valve; cold and water dip tube.
- G. Controls: Provide thermostat for each element, factory wired.
- H. Manufacturers: Subject to compliance with requirements, provide residential electric water heaters of one of the following:
 1. Lochinvar Water Heater Corp.
 2. Rheem Water Heater Div; City Investing Co.
 3. Ruud Water Heater Div; City Investing Co.
 4. Smith Corp. (A.O.); Consumer Products Div.
 5. Bradford White Corporation

2.2 ELECTRIC TANKLESS WATER HEATERS:

- A. General: Comply with UL 499.
- B. Construction: With hot water storage. Working pressure rating of 125 psig minimum.
 - 1. Tapings: ASME B1.20, pipe thread.
 - 2. Interior finish: Materials complying with NSF 61, barrier materials for potable water tank linings.
 - 3. Jacket: Aluminum or steel, with enameled finish, or plastic.
 - 4. Heating system: Electric resistance type, field serviceable replaceable cartridge element.
 - 5. Temperature control: Microprocessor fully adjustable temperature range.
 - 6. Mounting: Bracket or device for wall mounting.
- C. Manufacturers: Subject to compliance with requirements, provide electric tank-less water heaters of one of the following:
 - 1. Chronomite Laboratories, Inc.
 - 2. Eemax, Inc.
 - 3. PVI Industries, Inc.
 - 4. Stiebel Eltron, Inc.

2.3 THERMAL EXPANSION ABSORBERS:

- A. Furnish and install where indicated on Contract Documents thermal expansion absorber constructed of materials suitable for potable water.
- B. Size and number as indicated, constructed of welded carbon steel for 125 psig working pressure.
- C. Separate air charge from system water to maintain design expansion capacity, by means of a flexible diaphragm securely sealed into the tank.
- D. Provide taps for pressure gage and air charge fitting and drain fitting. Support vertical tanks with steel legs or base: support horizontal tanks with steel saddles.
- E. Tank, with taps and supports, shall be constructed, tested and labeled in accordance with ASME Pressure Vessel Code, Section VIII, Section 1.
- F. Manufacturers: Subject to compliance with requirements, provide thermal expansion absorbers of one of the following:
 - 1. Amtrol Inc.
 - 2. Bell & Gossett ITT: Fluid Handling Div.
 - 3. Armstrong Pumps, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine areas and conditions under which water heaters are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF WATER HEATERS:

- A. General: Install water heaters in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support: Place units on concrete pads, orient so controls and devices needing service and maintenance have adequate access.
- C. Piping: Connect hot and cold-water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve, and union. Extend relief valve discharge to closest floor drain or as indicated.
- D. Gages: Provide thermometers on inlet and outlet piping of water heaters, in accordance with Basic Mechanical Materials and Methods Section "Meters and Gages."

3.3 ELECTRIC WIRING:

- A. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
- B. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with water heater start-up until wiring installation is acceptable to water heater Installer.

3.4 INSTALLATION OF THERMAL EXPANSION ABSORBERS

- A. General: Install thermal expansion absorbers in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support: Place units, orient so controls and devices needing service and maintenance have adequate access.
- C. Piping: Provide cold water piping connections to units with unions.

3.5 CLOSEOUT PROCEDURES

- A. Training: Provide services of manufacturer's technical representative for 1- half day to instruct Owner's personnel in operation and maintenance of water heaters.
- B. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

END OF SECTION 15461

SECTION 15530 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 15 Sections apply to this section:
 - 1. Basic Mechanical Materials and Methods.

1.2 SUMMARY:

- A. This Section includes refrigerant piping used for air conditioning applications. This Section includes:
 - 1. Pipes, tubing, fittings, and specialties.
 - 2. Special duty valves.
 - 3. Refrigerants.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 7, Section "Joint Sealers" for materials and methods for sealing pipe penetrations through walls.
 - 2. Division 15, Section "Mechanical Identification" for labeling and identification of refrigerant piping.
 - 3. Division 15, Section "Mechanical Insulation" for pipe insulation.
- C. Products installed but not furnished under this Section include pre-charged tubing, refrigerant specialties, and refrigerant accessories furnished as an integral part of or separately with packaged air conditioning equipment.

1.3 SUBMITTALS:

- A. Product data for the following products:
 - 1. Each type valve specified.
 - 2. Each type refrigerant piping specialty specified.
- B. Shop Drawings from the equipment manufacturer showing layout of refrigerant piping, specialties, and fittings including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximate to equipment.

1.4 QUALITY ASSURANCE:

- A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".
- B. Regulatory Requirements: Comply with provisions of the following codes:
 - 1. ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping.
 - 2. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.
 - 3. International Mechanical Code

1.5 SEQUENCING AND SCHEDULING:

- A. Coordinate the installation of roof piping supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following.
- B. Refrigerant Valves and Specialties:
 - 1. Alco Controls Div, Emerson Electric.
 - 2. Danfoss Electronics, Inc.
 - 3. EATON Corporation, Control Div.
 - 4. Henry Valve Company.
 - 5. Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
 - 6. Sporlan Valve Company.

2.2 PIPE AND TUBING MATERIALS

- A. General: Refer to Part 3, Article "PIPE APPLICATION" for identification of systems where the below specified pipe and fitting materials are used.
- B. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

2.3 FITTINGS:

- A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

2.4 JOINING MATERIALS:

- A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

2.5 VALVES:

- A. General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.
- B. Globe: 450 psig maximum operating pressure, 275 deg. F maximum operating temperature; cast bronze body, with cast bronze or forged brass wing cap and bolted bonnet; replaceable resilient seat disc; plated steel stem. Valve shall be capable of being repacked under pressure. Valve shall be straight through or angle pattern, with solder-end connections.

2.6 REFRIGERANT PIPING SPECIALTIES:

- A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.
- B. Strainers: 500 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.
- C. Moisture/Liquid Indicators: 500 psig maximum operation pressure, 200 deg. F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.
- D. Permanent Filter-Drier: 350 psig maximum operation pressure, 225 deg. F maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant. for removal of acids and moisture for refrigerant vapor.
- E. Replaceable Core Filter-Drier: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings

for solder end connections. Furnish complete with replaceable filter core kit, including gaskets, as follows:

1. Standard capacity desiccant sieves to provide micron filtration, ARI 730 rated for capacity.
- F. Flanged Unions: 400 psig maximum working pressure, 330 deg. F maximum operating temperature; two brass tailpiece adapters for solder end connections to copper tubing; flanges for 7/8 inch through 1-5/8 inch unions shall be forged steel, and for 2-1/8 inch through 3-1/8 inch shall be ductile iron; four plated steel bolts, with silicon bronze nuts and fiber gasket. Flanges and bolts shall have factory-applied rust-resistant coating.
- G. Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.

2.7 REFRIGERANT:

- A. Refrigerant R-134a, in accordance with ASHRAE Standard 34.
- B. Refrigerant R-410a, in accordance with ASHRAE Standard 34.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.

3.2 PIPE APPLICATIONS:

- A. Use Type K, or Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Use Type K, annealed temper copper tubing for 2 inch and smaller without joints, below ground and within slabs. Mechanical fittings (crimp or flair) are not permitted.
- B. If other than Type ACR tubing is used, clean and protect inside of tubing as specified in Article "CLEANING" below.

3.3 PIPING INSTALLATIONS:

- A. General: Install refrigerant piping in accordance with ASHRAE Standard 15 - "The Safety Code for Mechanical Refrigeration."
- B. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.
- C. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.
- D. Insulate suction lines. Liquid line are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.
 1. Do not install insulation until system testing has been completed and all leaks have been eliminated.
- E. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- F. Roof Penetrations: Pipes shall penetrate roof through a pipe curb assembly, (insulated) with thermoplastic cover, sleeves scored for pipe sizes, graduated water-tight boots, and steel clamps, like patch peg-2. Roof warranty must be maintained.

- G. Install moisture/liquid indicators in liquid lines between filter/dryers and thermostatic expansion valves and in liquid line to receiver.
 - 1. Install moisture/liquid indicators in lines larger than 2-1/8 inch OD, using a bypass line.
- H. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.

3.4 HANGERS AND SUPPORTS:

- A. General: Hanger, supports, and anchors are specified in Division 15 Section "SUPPORTS AND ANCHORS." Conform to the table below for maximum spacing of supports:
- B. Install hangers with the following minimum rod sizes and maximum spacing:

NOM. PIPE SIZE	MAX. SPAN-FT	MIN. ROD SIZE – INCHES
1	7	3/8
1-1/2	9	3/8
2	10	3/8
3	12	1/2

3.5 PIPE JOINT CONSTRUCTION:

- A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
 - 1. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
 - 2. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.
- B. Fill the pipe and fittings during brazing, with an inert gas (ie., nitrogen or carbon dioxide) to prevent formation of scale.
- C. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

3.6 VALVE INSTALLATIONS:

- A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.
- B. Install globe valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.
- C. Install a full sized, 3-valve bypass around each drier.
- D. Install pressure relieving valves as required by ASHRAE Standard 15.

3.7 EQUIPMENT CONNECTIONS:

- A. The Drawings indicate the general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow servicing and maintenance.

3.8 FIELD QUALITY CONTROL:

- A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.
- B. Repair leaking joints using new materials, and retest for leaks.

3.9 CLEANING:

- A. Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedure:
 - 1. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
 - 2. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

3.10 ADJUSTING AND CLEANING:

- A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.
- B. Clean and inspect refrigerant piping systems in accordance with requirements of Division-15 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".
- C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.11 COMMISSIONING:

- A. Charge system using the following procedure:
 - 1. Install core in filter dryer after leak test but before evacuation.
 - 2. Evacuate refrigerant system with a reclaim vacuum pump; until temperature of 35 deg F is indicated on vacuum dehydration indicator.
 - 3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
 - 4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
 - 5. Break vacuum with refrigerant gas and allow pressure to build up to 2 psig.
 - 6. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.
- B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.
- C. Review data in Operating and Maintenance Manuals. Refer to Division 1 section "Project Closeout."
- D. Schedule training with Owner through the Architect, with at least 7 days advance notice.

END OF SECTION 15530

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SECTION 15548 – SEISMIC CONTROLS FOR MECHANICAL SYSTEMS

PART 1 - GENERAL REQUIREMENTS

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 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Division 20 Section “Seismic Controls for MEP/F/T Systems” for general requirement and related documents that apply to this section.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 SUMMARY

- A. Seismic bracing, restraints, and controls for all mechanical systems specified herein shall be designed and installed as required by Division 20 Section “Seismic Controls for MEP/F/T Systems”.

1.5 SUBMITTALS

- A. Provide submittals as required by Division 20 Section “Seismic Controls for MEP/F/T Systems” for all mechanical systems specified herein.

PART 2 - PRODUCTS AND MATERIALS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 15548

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SECTION 15549 – SEISMIC CONTROLS FOR PLUMBING

PART 1 - GENERAL REQUIREMENTS

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 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Division 20 Section “Seismic Controls for MEPFT Systems” for general requirement and related documents that apply to this section.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 SUMMARY

- A. Seismic bracing, restraints, and controls for all plumbing systems specified herein shall be designed and installed as required by Division 20 Section “Seismic Controls for MEP/F/T Systems”.

1.5 SUBMITTALS

- A. Provide submittals as required by Division 20 Section “Seismic Controls for MEP/F/T Systems” for all plumbing systems specified herein.

PART 2 - PRODUCTS AND MATERIALS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION 15549

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SECTION 15781 - COMPUTER ROOM AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications.
- B. Related Mechanical Specification Sections:
 - 1. Section 15010 - Basic Mechanical Requirements
 - 2. Section 15050 - Basic Mechanical Materials and Methods
 - 3. Section 15140 - Supports and Anchors
 - 4. Section 15411 - Water Distribution Piping
 - 5. Section 15530 – Refrigerant Piping

1.2 WORK DESCRIPTION:

- A. Scope of Work:
 - 1. Furnish and install computer/data processing room environmental control systems, including all equipment, refrigerant piping, refrigerant specialties, and all related items necessary for complete installation of configuration or type of units as shown and/or scheduled on the Mechanical Contract Documents.
 - 2. Electrical service to units shall be provided as specified under Division 16 Sections.
- B. Products Included:
 - 1. Ceiling-mounted computer room environmental control units with accessories

1.3 QUALITY ASSURANCE:

- A. Reference Standards:
 - 1. Unit efficiencies shall meet the requirements of ASHRAE Standard 90A: Energy Conservation in New Building Design.
 - 2. All units shall be listed by UL, ETL, CSA or other nationally recognized testing laboratory (NRTL) under the requirements of UL Standard 1995.
 - 3. Flame/smoke ratings of all internal insulation and components shall meet the requirements of ASTM E84.
- B. Each unit shall be completely factory assembled, piped, internally wired, charged, and fully tested in all modes of operation, prior to shipment.

1.4 SUBMITTALS:

- A. Submit descriptive product literature and shop drawings in accordance with Section 01340 of the General Requirements.
 - 1. Submittals and shop drawings shall include the following data:
 - a. Manufacturer's technical data including certified unit capacity.
 - b. Wiring schematics including ladder type diagrams which differentiate between factory installed and field installed portions.
 - c. Unit dimension data and weights.
 - d. Accessories furnished.

- e. Manufacturer's recommended installation methods.
 - f. Refrigerant piping installation diagrams.
- B. Submit maintenance manuals in accordance with Section 01730 of the General Requirements:
 - 1. Maintenance manuals shall include the following:
 - a. Parts lists for each type and size of unit
 - b. Published installation instructions.
 - c. Troubleshooting maintenance guide for each type of unit.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED COMPUTER ROOM ENVIRONMENTAL CONTROL UNITS:

- A. Unit Frame and Cabinet Construction:
 - 1. The unit frame shall be constructed of welded tubular steel and shall be painted for maximum corrosion protection. The exterior panels shall be powder coated and shall be insulated with a minimum 1 inch, 1-1/2 pound density fiber insulation. The main front panel shall have captive ¼ turn fasteners for easy service access.
 - 2. The filter chamber shall be an integral part of the unit, located within the cabinet and serviceable from the end of the unit. The filters shall be rated not less than 65% efficiency based on ASHRAE Standard 52-76.
- B. Fan Section:
 - 1. The fans shall be the centrifugal type, double width, double inlet, and shall be statically and dynamically balanced as a completed assembly to a maximum vibration level of two mils in any plane. The shaft shall be heavy duty steel with self-aligning ball bearings with a minimum life span of 100,000 hours. The fan motor shall be mounted on an adjustable slide base. The drive package shall be multi-belt, variable speed, sized for 200% of the fan motor horsepower. The fans shall be located to draw air over the A-Frame cooling coil to ensure even air distribution and maximum coil performance.
- C. Humidifier:
 - 1. The humidifier shall be of the infrared type consisting of high intensity quartz lamps mounted above and out of the water supply. The evaporator pan shall be stainless steel and arranged to be serviceable without disconnecting high voltage electrical connections. The complete humidifier section shall be pre-piped ready for final connection. The infrared humidification system shall use bypass air to prevent over-humidification of the computer room. The humidifier shall be equipped with an automatic water supply system. The system has an adjustable water-overfeed to prevent mineral precipitation.
- D. Reheat Coil:
 - 1. Provide low watt density electric reheat coils with tubular 304/304 stainless steel fin construction, protected by thermal safety switches and controlled in three stages.
- E. Evaporator Coil
 - 1. The evaporator coil shall be an A-frame design and shall be constructed of copper tubes and aluminum fins. Refrigerant of each system shall be distributed throughout the entire coil face area. A stainless steel condensate drain pan shall be provided underneath entire coil.
- F. Semi-Hermetic Compressors

1. The compressors shall be located in a separate compartment so they may be serviced during operations of the equipment. The compressor shall be semi-hermetic with a suction gas cooled motor vibration isolators, thermal overloads, oil sight glass, manual reset high pressure switch, pump down low pressure switch, suction line strainer, reversible oil pumps for forced feed lubrication. Each refrigeration circuit shall include hot gas mufflers, liquid line filter dryers, refrigerant sight glass with moisture indicator adjustable, externally equalized expansion valves, and liquid line solenoid valves.
- G. Four-Step Refrigeration System:
1. Provide cylinder unloaders on the semi-hermetic compressors which are activated by solenoid valves. The solenoid valves shall be controlled from the microprocessor control and shall activate the unloader solenoids and the liquid line solenoids such that multiple stages of refrigeration cooling are obtained.
 2. On a call for dehumidification, the microprocessor control shall insure that at least one compressor is on full for proper humidity control.
- H. Standard Control Processor:
1. The control system shall be a microprocessor based system with two 0.43 inch high, seven segment LED numerical displays to allow observation of room temperature and humidity and each settable function as follows:
 - a. Temperature Setpoint 35-85°F (18-29°C)
 - b. Temperature Sensitivity
 - c. Humidity Setpoint 40-60% R.H.
 - d. Humidity Sensitivity 1% to 10% R.H.
 - e. Humidifier Flush Rate
 2. Normal Operating Modes (Heating, Cooling, Humidification, and Dehumidification) shall be indicated by colored LED's on the unit mounted display panel.
 3. The control system shall monitor unit operations and activate an audible and visual alarm in the event of the following factory preset alarm conditions:
 - a. High Temperature
 - b. Low Temperature
 - c. High Humidity
 - d. Low Humidity
 - e. Restricted Air Filters
 - f. Loss of Air
 - g. High Head Pressure
 - h. Local Alarm
 4. Compressor Short Cycle Control:
 - a. The control system shall prevent compressor short cycling by a 3-minute timer from compressor stop to the next start.
- I. Air Cooled Condensers:
1. Exterior air cooled condensers shall be manufactured by the same manufacturer as the indoor unit and shall be the low profile, slow speed, multiple direct drive, propeller fan type. The condenser shall balance the heat rejection of the

compressor at minimum 95⁰F ambient temperature. The condenser shall be constructed of aluminum and contain a copper tube, aluminum fin coil arranged for vertical air discharge.

2. The winter control system for the air-cooled condenser shall be by fan speed control. The variable speed motors shall operate from 0 to 230 volts single phase, 10 to 1050 RPM and shall be designed with ball bearings, permanent lubrication, internal overload protection; 40 °C rise at full speed, 65 °C rise at 10 RPM.
3. The control system shall be complete with transducers thermostats and electrical control circuit, factory pre-packaged in the integral condenser control box. The transducer shall automatically sense the highest head pressure of either operating compressor and control the variable speed fan on the air-cooled condenser to properly maintain the head pressure. The fan speed control system shall provide positive start-up and operation in ambient temperature as low as - 20F.
4. Provide disconnect switch, factory mounted and wired to the condenser control panel, accessible from the exterior.
5. Provide winter control system for the air-cooled condenser which allows start-up and positive head pressure control with ambient temperatures as low as -30⁰F (-34.4⁰C). The package shall include the following components for each refrigeration circuit: insulated receiver, pressure relief valve, head pressure three-way control valve, and rotoloc valve for isolating the refrigerant charge. The receiver shall be factory insulated and mounted ready for the field connection to the air-cooled condenser. The heater shall require a separate power supply.

J. Optional Equipment:

1. Provide optional locking type manual disconnect switch mounted in the high voltage section of the electrical panel. The switch shall be from the outside of the unit with the door closed, and prevent access to the high voltage electrical components until switched to the "OFF" position.
2. Provide optional smoke detector mounted in the electrical panel with the sensing element in the return air compartment. The smoke detector shall immediately shut down the environmental control system and activate the alarm system when activated.
3. Provide optional firestat mounted in the electrical panel with the sensing element in the return air. The firestat shall immediately shut down the environmental control system when activated.
4. Provide optional condensate pump complete with integral float switch, pump and motor assembly, and reservoir. The condensate pump shall have a minimum capacity of 100 GPH at 20 ft.hd. Provide two solid state water sensors under the raised floor.

K. Warranty:

1. Provide written warranty, signed by manufacturer, against defects and workmanship for a period of one (1) year following the date of substantial completion on all parts. Warranty coverage of all compressors shall be for a period of five (5) years from date of substantial completion

L. Acceptable Manufacturers:

1. APC
2. Compu-Aire, Inc.
3. Data Aire Inc.
4. Liebert (Basis of Design)

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. All units shall be installed in accordance with manufacturer's installation instructions. Install units plumb and level, anchored in locations indicated, while maintaining manufacturer's recommended service clearances.
- B. Vibration Isolation:
 - 1. Provide spring vibration isolators at each corner unit sized by manufacturer for corner weights.
- C. Furnish and install all refrigerant piping, humidifier piping, control wiring, and condensate drain piping as denoted. Refrigerant piping shall be confirmed by the unit manufacturer for the distance and elevation requirements for the project.
- D. Furnish copy of manufacturer's wiring diagram submittal to Division 16 contractor.

3.2 START-UP:

- A. The manufacturer must provide a factory-trained service technician to supervise the original start-up of the unit(s). Start-up units in accordance with manufacturer's start-up instructions. Test unit controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.3 TRAINING:

- A. Provide services of manufacturer's technical representative for 1-half day to instruct Owner's personnel in proper operation and maintenance of each unit. Schedule training with Owner, providing at least a 7-day notice to the Engineer prior to training date.

END OF SECTION 15781

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SECTION 15782 - ROOFTOP UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

- A. This Section includes packaged rooftop heating and cooling units.

1.3 SUBMITTALS:

- A. Product Data: Include manufacturer's technical data for each model indicated; including rated capacities of selected model clearly indicated; dimensions; required clearances; shipping installed, and operating weights; furnished specialties; accessories; and installation and startup instructions.
- B. Shop, Drawings: Detail equipment assemblies and indicate dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection. Detail mounting, securing and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
- C. Wiring Diagrams: Detail wiring for power and control systems and differentiate between manufacturer-installed and field-installed wiring.
- D. Commissioning Reports: Indicate results of startup and testing commissioning requirements. Submit copies of checklists to Owner.
- E. Maintenance Data: Provide maintenance manuals for each piece of equipment to be included in the maintenance manuals specified in Division 1.
- F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE:

- A. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration".
- B. Energy Efficiency Ratio: Equal to or greater than prescribed by *[Specifier—insert site specific energy code]*.
- C. Coefficient of Performance: Equal to or greater than prescribed by *[Specifier—insert site specific energy code]*.
- D. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency, Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- E. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver rooftop units as factory-assembled units with protective crating and covering.
- B. Handle rooftop units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

1.6 COORDINATION:

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations with roof construction.

1.7 WARRANTY:

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents
- B. Special Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials or workmanship, within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.
- C. Warranty Period. Compressors: Manufacturer's standard, but not less than 5 years after date of Substantial Completion.

1.8 EXTRA MATERIALS:

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
- B. Fan Belts: One set for each belt-drive fan.
- C. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with the requirements of the documents, products by the following manufacturer approved by the Owner:
 - 1. Lennox Industries, Inc. - National Account Representative
Contact: J. R. Penisten
Ph: (800) 367-6285
Email: JR.Penisten@Lennoxind.com

2.2 ROOFTOP UNITS SMALLER THAN 6 TONS:

- A. Description: Factory assembled and tested; designed for roof installation; and consisting of compressor, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, filters, and dampers.
- B. Casing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch-thick thermal insulation, knockouts for electrical connections, exterior condensate drain connection, and lifting lugs.
- C. Evaporator Fans: Forward curved, centrifugal, directly driven with permanently lubricated motor bearings.
- D. Exhaust/Relief Fans: Forward-curved, centrifugal or propeller type, directly driven with permanently lubricated motor bearings.
- E. Condenser Fans: Propeller type, directly driven with permanently lubricated motor bearings.
- F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in galvanized steel casing with equalizing-type vertical distributor,
- G. Compressors: Hermetic with integral vibration isolators and crankcase heater.

- H. Gas Heat: Manufacturer's standard aluminized steel construction, electronic direct spark ignition, electronic flame sensor, combustion air inducer, redundant automatic dual stage gas valve with manual shut-off.
- I. Economizer Control: Return- and outside-air dampers, outside-air filter, fully modulating electronic-control system with adjustable mixed-air thermostat and automatic changeover.
- J. Required Options:
 - 1. Through-the-base electrical provision.
 - 2. Hinged service access.
 - 3. Factory installed condenser hail guards on all sides.
 - 4. Factory mounted disconnect switch
 - 5. Factory mounted and wired GFI convenience outlet

2.3 ROOFTOP UNITS, 7-1/2 TONS AND ABOVE:

- A. Description: Factory assembled and tested; designed for roof installation; and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, filters, and dampers.
- B. Casing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch-thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.
- C. Evaporator Fans: Forward curved, centrifugal, belt driven with adjustable sheaves or direct-drive fans; and with permanently lubricated motor bearings.
- D. Exhaust/Relief Fans: Forward-curved, centrifugal or propeller type, directly driven with permanently lubricated motor bearings.
- E. Condenser Fans: Propeller type, directly driven with permanently lubricated motor bearings.
- F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in galvanized steel casing with equalizing-type vertical distributor.
- G. Compressors: Serviceable, semi-hermetic, or fully hermetic compressors with integral vibration isolators and crankcase heaters.
- H. Safety Controls: For semi-hermetic compressors provide manual-reset type safety controls for low pressure, high pressure, and compressor motor overload protection.
- I. Timed-Off Control: Automatic-reset control shuts compressor off after 5 minutes.
- J. Gas Heat: Manufacturer's standard aluminized steel construction, electronic direct spark ignition, electronic flame sensor, combustion air inducer, redundant automatic dual stage gas valve with manual shut-off.
- K. Economizer Control: Return- and outside-air dampers, outside-air filter, fully modulating electronic-control system with adjustable mixed-air thermostat and automatic changeover through adjustable enthalpy-control device.
- L. Required Options:
 - 1. Through-the-base electrical provision.
 - 2. Hinged service access.
 - 3. Barometric relief.
 - 4. Factory installed condenser hail guards on all sides.
 - 5. Factory mounted disconnect switch

6. Factory mounted and wired GFI convenience outlet

2.4 CONTROL REQUIREMENTS:

A. Temperature Control Components:

1. Units shall be provided from the factory with BacNET communications interface installed. Wall mounted sensors shall be provided for each zone, wired back to the rooftop unit with 2-wire shielded cable. Rooftop unit microprocessors shall be interconnected, and the end units connected to the nearest JACE as specified in the Building Automation specification section.
2. Shielded cable shall be stranded tinned copper conductors insulated with polyethylene, conductors shielded with overall aluminum/polyester tape and stranded tinned copper drain wire. Specifications shall meet the following:
 - a. Number of conductors: 2
 - b. AWG Strand: 18 gauge (16 strands of 30 gauge per strand)
 - c. Insulation thickness: 0.018 inches
 - d. Jacket thickness: 0.028 inches
 - e. Capacitance between conductors: 24 Picafarads/foot
3. Unit shall have capability for running control circuit through auxiliary contacts for tie-in to fire alarm system by the Owner's designated fire alarm contractor.

2.5 ROOF CURBS:

A. Subject to compliance with the requirements of the documents, products by the following manufacturer approved by the Owner:

1. AES Industries - National Account Representative
Contact: Paul Ledbetter
Ph: (800) 786-0402
Email: pledbetter@aescurb.com
2. Curbs Plus, Inc. (Used for HVAC Unit replacement curbs)
Contact: Steve Jensen
Ph: (888) 639-2872
Email: steve.jensen@curbs-plus.com

B. Manufacturer's standard, insulated with corrosion-protection coating, gasketing, factory-installed wood nailer, according to NRCA standards.

C. Curb Height: Minimum *[Specifier—provide height]* inches.

2.6 MOTORS:

- A. Refer to Division 15 Section "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT" for general requirements for factory-installed motors.
- B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
- C. Enclosure Type: Open, drip-proof

2.7 SOURCE QUALITY CONTROL:

- A. Verification of Performance: Rate capacity according to ARI 210/240, "Unitary Air-Conditioning and Air Source Heat Pump Equipment."
- B. Verification of Performance: Rate capacity according to ARI 360, 'Commercial and Industrial Unitary Air-Conditioning Equipment.'
- C. Sound Power Level Ratings: Comply with ARI 270, "Standard for Sound Rating of Outdoor Unitary Equipment.'

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine roof for compliance with requirements for conditions affecting installation and performance of rooftop units. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. Install units according to manufacturer's written instructions.
- B. Install units level and plumb, maintaining manufacturer's recommended clearances.
- C. Curb Support: Install roof curb on roof structure, level, according to NRCA's written installation instructions. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing with roof construction.
- D. Unit Support: Install unit on structural curbs and level. Coordinate wall penetrations and flashing with wall construction.

3.3 CONNECTIONS:

- A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination in roof mounting frames.
 - 2. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit.
- B. Electrical: Conform to applicable requirements in Division 16 Sections.
- C. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 COMMISSIONING:

- A. Verify that installation is as indicated and specified.
- B. Complete manufacturer's installation and startup checks and perform the following:
 - 1. Level unit on housekeeping base, and flash curbs to unit and to roof.
 - 2. Inspect for visible damage to unit casing.
 - 3. Inspect for visible damage to compressor, air-cooled condenser coil, and fans.
 - 4. Verify that clearances have been provided for servicing.
 - 5. Check that labels are clearly visible.
 - 6. Verify that controls are connected and operable.
 - 7. Remove shipping bolts, blocks, and tie-down strap.
 - 8. Verify that filters are installed.
 - 9. Adjust vibration isolators.
 - 10. Check acoustic insulation.
 - 11. Check operation of barometric dampers.
- C. Lubricate bearings on fan.
- D. Check fan-wheel rotation for correct direction without vibration and binding.

- E. Adjust fan belts to proper alignment and tension
- F. Start unit according to manufacturer's written instructions.
 - 1. Perform starting of refrigeration in summer only.
 - 2. Complete startup sheets and attach copy with Contractor's startup report
- G. Check and record performance of interlocks and protection devices; verify sequences.
- H. Operate unit for an initial period as recommended or required by manufacturer.
- I. Adjust and check high-temperature limits.
- J. Check internal isolators.
- K. Check outside-air damper for proper stroke and interlock with return-air dampers.
- L. Check controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
- M. Start refrigeration and measure and record the following:
 - 1. Coil leaving-air, dry- and wet-bulb temperatures.
 - 2. Coil entering-air, dry- and wet-bulb temperatures.
 - 3. Outside-air, dry-bulb temperature.
 - 4. Air-cooled-condenser discharge-air, dry-bulb temperature.
- N. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - 1. Supply-air volume.
 - 2. Return-air volume.
 - 3. Relief-air volume.
 - 4. Outside-air intake volume.
- O. Simulate maximum cooling demand and check the following:
 - 1. Compressor refrigerant suction and hot-gas pressures.
 - 2. Short circuiting air through condenser or from condenser to outside-air intake.
- P. Verify operation of remote panel, including pilot-light operation and failure modes. Check the following:
 - 1. Warm-up for morning cycle.
 - 2. Freezestat operation.
 - 3. Free-cooling mode, outside-air changeover.
 - 4. Alarms
- Q. After starting and performance testing change filters, vacuum cooling and condenser coils, lubricate bearings, adjust belt tension, and check operation of power vents.
- R. Complete the **HVAC EQUIPMENT STARTUP PROCEDURES STARTUP RECORD**, attached. Report is required for each unit.

3.5 DEMONSTRATION:

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
- B. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

- C. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
- D. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION 15782

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SECTION 15860 - CENTRIFUGAL UTILITY FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specification Sections and other Division-15 Specification Sections, apply to work of this Section.
- B. The requirements of the following Division 15 Sections apply to this Section.
 - 1. "Basic Mechanical Requirements"
 - 2. "Basic Mechanical Materials and Methods"
 - 3. "Electrical Requirements for Mechanical Equipment"

1.2 DESCRIPTION OF WORK:

- A. Extent of centrifugal fans work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. Types of centrifugal fans required for project include the following:
 - 1. Centrifugal Fans
- C. Refer to Division-15 Sections for testing, adjusting, and balancing work required in conjunction with centrifugal fans; not work of this Section.
- D. Refer to Division-16 Sections for the following work; not work of this Section.
 - 1. Power supply wiring from power source to power connection on fan motor. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
 - 2. Interlock wiring between fan units; and between fans and field-installed control devices.

1.3 QUALITY ASSURANCE:

- A. AMCA Compliance: Provide centrifugal fans bearing the AMCA Certified Ratings Seal. Sound rate centrifugal fans in accordance with AMCA 300 "Test Code for Sound Rating Air Moving Devices.
- B. ASHRAE Compliance: Test and rate centrifugal fans in accordance with ASHRAE 51 (AMCA 210) "Laboratory Methods of Testing Fans for Rating."
- C. UL Compliance: Provide centrifugal fan electrical components which have been listed and labeled by UL.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for centrifugal fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated; gages and finishes of materials, dimensions, weights, accessories furnished, and installation instructions.
- B. Shop Drawings: Submit assembly-type shop drawings showing fan dimensions, required clearances, construction details, and field connection details.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to fan units.
- D. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

- E. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data, product data, shop drawings, and wiring diagrams in maintenance manuals; in accordance with requirements of Division-1.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver centrifugal fans with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handle centrifugal fans carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to centrifugal fan manufacturer.
- C. Store centrifugal fans in clean dry place and protect from weather and construction traffic.
 - 1. Comply with manufacturer's rigging and installation instructions for unloading centrifugal fans and moving them to final location.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL FANS:

- A. General: Provide centrifugal fans of sizes and arrangement as indicated and of capacities and having accessories as scheduled.
- B. Fan Units: Provide factory-assembled and tested fan units consisting of housing, wheel, fan shaft, bearings, and side support structure. Clean, condition, and prime paint sheet metal parts prior to final assembly. Apply final coat of enamel to exterior surfaces after assembly.
- C. Housings: Provide curved scroll housings; lockseam construction for sizes 24" to 40", spot welded construction for sizes 44" to 60", and continuous weld construction for sizes 66" and larger. Provide horizontally split housings, bolted together for sizes 66" and larger. Provide spun inlet cents and duct connections.
- D. Wheels: Provide backwardly inclined plate-type blades for sizes 22" and smaller, non-power-overloading backwardly inclined air foil blades for sizes 24" and larger. Weld blades to wheel rim and hub plate.
- E. Key wheels to shafts. True and dynamically balance wheels after assembly.
- F. Shafts: Construct of AISC 1040 or 1045 solid hot-rolled steel, turned and polished.
- G. Bearings: provide heavy-duty, grease-lubricated, precision anti-friction ball or roller. Self-aligning pillow block type bearings selected for minimum average life AFBMA L50 of 100,000 hours.
- H. Bearings: Provide extra heavy-duty, grease-lubricated, tapered double spherical rollers, pillow block type bearings selected for minimum average life AFBMA L50 of 400,000 hours.
- I. Motors: Provide energy efficient motors in accordance with Division-15 Section "Electrical Provisions of Mechanical Work."
- J. Drive: Provide V-belt drive, selected for 1.4 service factor. Provide adjustable pitch sheave, selected for midpoint at design conditions.
- K. Accessories: Provide the following accessories as indicated and/or scheduled:
 - 1. Access Doors: Provide access door in scroll housing, with latch type handles, flush mounted for uninsulated housings, and raised-mounted for insulated housings.
 - 2. Belt Guards: Provide protective enclosure around moving parts with removable Sections or opening for tachometer.

3. Drain Connections: Provide 3/4" threaded coupling drain connection at lowest point of housing.
4. Extended Grease Lines: Extend grease lines from bearings to outside of inlet duct flange, terminate with grease fitting.
5. Spark-Resistant Construction: Provide AMCA construction option: A, B, or C as indicated.
6. Split Housings: Provide flanged, horizontally split housings as indicated.
7. Shaft Seals: For single width fans, provide tight seal around shaft on drive side.
8. Special Coatings: Provide protective coatings on fans as indicated.
- L. Manufacturer: Subject to compliance with requirements, provide centrifugal fans of one of the following:
 1. Barry Blower; A Marley Co.
 2. Bayley Propellair Group; Lau Div. of Philips Industries, Inc.
 3. Buffalo Forge Co.
 4. Greenheck
 5. Loren Cook Company
 6. Chicago Blower Corp.
 7. New York Blower Co.
 8. Twin City Fan and Blower Co.
 9. Westinghouse Electric Corp.; Sturtevant Div.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which centrifugal fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF CENTRIFUGAL FANS:

- A. General: Install centrifugal fans where indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to ensure that centrifugal fans comply with requirements and serve intended purposes.
- B. Access: Provide access and service space around and over centrifugal fans as indicated, but in no case less than that recommended by manufacturer.
- C. Isolation: Set centrifugal fans on vibration isolators, fasten in accordance with manufacturer's installation instructions.
- D. Electrical Wiring: Install electrical devices furnished by manufacturer, but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
- E. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 Sections. Ensure that rotation is in direction indicated and intended for proper performance. Do not proceed with centrifugal fan start-up until wiring installation is acceptable to centrifugal fan Installer.
- F. Ductwork Connections: Refer to Division-15 "Ductwork" Sections. Provide flexible connections on inlet and outlet duct connections.

3.3 FIELD QUALITY CONTROL:

- A. Upon completion of installation of centrifugal fans, and after motor has been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

3.4 ADJUSTING AND CLEANING:

- A. Start-up, test, and adjust centrifugal fans in presence of manufacturer's authorized representative.

3.5 SPARE PARTS:

- A. General: Furnish to owner, with receipt, one spare set of belts for each belt driven centrifugal fan.

END OF SECTION 15860

SECTION 15870 – EXHAUST FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification Sections and other Division 15 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK:

- A. The Contractor shall furnish all the labor, materials, equipment, appliances, services and drayage, and perform all the operations in connection with the construction and installation of the Work. All Work to be as herein specified and as denoted on the accompanying Drawings.
- B. This Section of the Work includes the furnishing and installation of roof-mounted powered exhaust ventilators, complete with associated ductwork, dampers, etc., as herein specified and/or indicated on the Drawings.

1.3 QUALITY ASSURANCE:

- A. Units shall be licensed to bear the Air Moving and Conditioning Association, Inc. (AMCA) seal for air moving performance shall be tested in accordance with AMCA Standard 210.
- B. Some ratings listed for specific performances shall be in accordance with methods outlined in AMCA Bulletin 301.
- C. UL Compliance - Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."
- D. NEMA Compliance - Motors and electrical accessories shall comply with NEMA standards.
- E. Electrical Component Standard - Components and installation shall comply with NFPA 70 "National Electrical Code."
- F. Manufacturers: Subject to compliance with requirements provide exhaust fans of one of the following manufacturers
 - 1. Greenheck Fan Corp.
 - 2. Loren Cook Co.

1.4 SUBMITTALS:

- A. General - Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
- B. Product Data - for selected models, including specialties, accessories, and the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound power ratings.
 - 3. Motor ratings and electrical characteristics plus motor and fan accessories.
 - 4. Materials gauges and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.

PART 2 - PRODUCTS

2.1 BELT DRIVEN ROOF EXHAUST FANS:

- A. Belt driven roof exhaust fans shall be the centrifugal blower type with fan housing constructed of heavy gauge spun aluminum, mounted upon a rigid support and bird screen

network of coated steel. The fan inlet shall have a spun venturi throat overlapped by a backward curved centrifugal wheel with spun cone for maximum performance.

1. The motor and drive housing shall be mounted on vibration isolators and shall be completely sealed from the exhausted air and fumes.
2. The motor cooling air shall be taken into the chamber from a location free of discharge contaminates.
3. The entire drive assembly and wheel, as a unit, shall be removable through the support structure without dismantling the fan housing in any way.
4. The wheel shaft shall be mounted in heavy duty ball bearing pillow blocks. Both pulleys shall be fully machined cast iron type keyed to the wheel and motor shafts. Motor pulley to be variable pitch adjustable.
5. Provide an integral UL approved safety disconnect switch as recommended by the manufacturer for all units, mounted under motor dome.
6. Provide a backdraft damper in the inlet neck.

2.2 ROOF CURBS:

- A. Roof curbs fabricated by the same manufacturer as the powered roof exhausters shall be provided.
- B. The outer shell of the curb is to be formed and welded with wide mounting flange, constructed of galvanized steel. The corners are to be welded continuously to form a one-piece leakproof shell. The bottom of the curb is to have a base plate which encloses the lower edge of the insulation. Backdraft dampers are required on all units and damper holding trays are required.
- C. Rigid fiberglass insulation is to be firmly secured to the inside of the curb with metal clips. Wooden nailing strips are to be secured at the top of the curb shell to provide means for easily attaching the flashing material and equipment to the curb.
- D. Minimum curb height above finished roof shall be 12".
- E. This Contractor shall be responsible for furnishing and installing the equipment mounting roof curb immediately after he prepares the opening through the roof. The roofer then may run the flashing or roofing material up to the top of the curb and secure to the nailer base so that the ventilator base forms a counterflashing when installed on the curb. A temporary weather cap/covering shall also be securely installed immediately after field flashing.

PART 3 - EXECUTION

3.1 GENERAL

- A. Mount roof exhaust fans on the roof curbs after all roofing flashing and counterflashing has been completed. Unless specifically scheduled on the Drawings to have hinged curbs, all fan mounting bases shall be securely fastened to the wood nailer by means of a minimum of two (2) rustproof round head wood screws on each side of the base flange.
- B. Check all units for proper performance, fan and/or motor rotation, and adjust as required.
- C. Refer to Specification Section 15190 for proper identification tagging of equipment.

END OF SECTION 15870

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SECTION 15891 - LOW PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specifications sections apply to work of this section.
- B. The requirements of the following Division 15 sections apply to this Section:
 - 1. "Basic Mechanical Requirements"
 - 2. "Basic Mechanical Materials and Methods"
 - 3. "Flexible Ductwork"

1.2 WORK DESCRIPTION:

- A. Scope of Work:
 - 1. Furnish and install low pressure ductwork as shown or implied on the Contract Documents.
 - 2. Extent of the work is indicated on the Drawings and in the schedules, and by requirements of this section. Low pressure ductwork is hereby defined as ductwork subjected to velocities of less than 2500 fpm or less and operating pressure of 2" water column (w.c.) or less, positive or negative.
- B. Work Included:
 - 1. Heating supply and return air duct systems.
 - 2. Air conditioning supply and return duct systems.
 - 3. Mechanical exhaust ducts.

1.3 QUALITY ASSURANCE:

- A. Construction Standards:
 - 1. All ducts shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards.
 - 2. Where SMACNA standards provide no guidance, comply with ASHRAE Handbook of Fundamentals chapter on Duct Construction.
 - 3. Comply with ANSI/NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

1.4 SUBMITTALS:

- A. Submit descriptive literature and shop drawings for manufactured products and factory fabricated ductwork in accordance with Division 1 requirements.

1.5 RECORD DRAWINGS:

- A. Submit Record Drawings in accordance with Division 1 requirements.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Protect shop fabricated and factory fabricated ductwork, accessories and purchased products from damage during shipment, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Where possible, store ductwork inside and protect from the weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Metal duct:
 - 1. U.S. Steel
 - 2. Republic Steel
 - 3. Wheeling Steel
 - 4. Norfolk
- B. Factory Fabricated Round or Oval Ductwork
 - 1. C & R
 - 2. Dixie Sheetmetal
 - 3. LaPine
 - 4. Lindab
 - 5. Semco
 - 6. Tangent Air
 - 7. United Sheetmetal Div. United McGill Corp.
- C. Duct sealant:
 - 1. United Duct Sealant
 - 2. Hardcast

2.2 DUCTWORK:

- A. General: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual defects and imperfections including fittings, seam markings, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.
- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet metal steel complying with ANSI/ASTM A 653, lockforming quality and ANSI/ASTM A 653M, G90 zinc coating; mill phosphatized for exposed locations.
- C. Rectangular Ductwork:
 - 1. Ductwork shall be fabricated of gages and reinforcement complying with SMACNA Standards, and shall be of sizes as shown on Drawings. Dimensions as shown are inside measurements indicating free area required. Ducts noted to receive liner shall be increased in size to maintain the inside dimensions noted.
 - 2. Minimum rectangular duct sheet metal gauges shall be as follows:

Dimension of Longest Side	Gauge
Up through 12"	26
through 30"	24
through 54"	22
through 84"	20
- D. Round Ductwork:
 - 1. Round ducts shall be factory fabrication zinc coated steel of spiral lockseam construction.

2. Round duct fittings shall be factory fabricated zinc coated steel for 45 or conical take-off from the main trunk. Fittings shall be minimum 20 gauge.
3. Minimum round duct metal gauges for low pressure ductwork shall be as follows:

Duct Diameter	Gauge
Up through 8"	26
through 22"	24
through 36"	22

2.3 MISCELLANEOUS DUCTWORK MATERIALS:

- A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Duct Liner Adhesive: Comply with American Society for Testing and Materials (ASTM) ASTM 916 "Specifications for Adhesives for Duct Thermal Insulation." Duct liner shall be adhered to the sheet metal and, where required, edges coated with one of the adhesives conforming to the Standard for Adhesives for Duct Liner, ASC-A-7001C-1972, of the Adhesive and Sealant Council, Inc.
- C. Duct liner shall be further secured with fasteners conforming to the Mechanical Fastener Standard, MF-1-1975, on page 22 of the Duct Liner Application Standard, second edition, of the Sheet Metal and Air Conditioning Contractor's National Association.
- D. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
- E. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- F. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

2.4 INTERNAL DUCT LINER:

- A. Duct-Liner: Fibrous glass, complying with American Society for Testing Materials (ASTM) ASTM C 1071; of thickness indicated. be 1" thick composed of long textile type glass fibers firmly bonded in random orientation with a thermosetting phenolic resin minimum density of 1.5 lb/cu.ft., thermal conductivity of 0.24 at 75 F differential, minimum sound absorption co-efficient of 0.67 at 500 Hz based upon ASTM Test Method C-423-60T, and able to withstand velocities up to 4000 feet per minute.
- B. Unless otherwise indicated, the net free area of the duct dimensions given on the Drawings shall be maintained. Increase metal duct dimensions as necessary to compensate for addition of the liner.
- C. The interior duct insulation shall be applied as recommended by the manufacturer including proper adhesive and adhered clips. Clip spacing shall not exceed 8" on center perpendicular to air flow and shall not exceed 12" on center in the direction of air flow.
- D. All joints of the insulation shall have edges buttered with sealant, and shall be tightly buffed. Apply a brush coat of sealant at all joints on the surface of the duct liner extending at least 1" on each side of joint.
- E. Provide metal nosing on all exposed edges of duct liner at fire dampers, control dampers, fan discharges, etc.
- F. Liner may be adhered to the sheet metal before it is formed into ducts provided care is taken not to damage the insulation.

- G. The following ductwork shall be internally lined:
 - 1. Rectangular return air ductwork up to the rooftop units.
 - 2. Transfer duct plenums between adjacent spaces.
 - 3. Minimum of the first ten (10) feet of supply discharge off of each rooftop unit.
- H. The following ductwork shall be externally insulated and is work of another section:
 - 1. All other ductwork

PART 3 - EXECUTION

3.1 GENERAL:

- A. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5 % leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints.
- B. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold duct true-to shape and to prevent buckling.
- C. Provide all necessary offsets and transformations as required in the installation of the work although same may not be specifically shown on the plans. Offset all ducts as required to increase head room under them, to improve the appearance of exposed ducts, and to avoid interference with the work of other trades.
- D. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible.
- E. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment.
- F. Hold ducts close to walls overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.
- G. Where possible, in finished and occupied spaces, conceal ductwork from view, by locating above suspended ceilings. Coordinate the layout with suspended ceiling and lighting layouts and similar finished work.
- H. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on four sides by at least 1-1/2".
- I. Support ductwork in manner complying with SMACNA 1995 Second Edition, "HVAC Duct Construction Standards" hanger and supports Section.

3.2 INSTALLATION OF RECTANGULAR DUCTWORK:

- A. Field changes in duct dimensions shall result in equivalent cross-sectional areas to dimensions shown. In no case shall the greater dimension be greater than four times the lesser.
- B. All transitions shall be made with long transition fittings. Ducts shall be flared to suit shape of registers and grilles or openings for registers and grilles. Maximum angle of transition of 20 for diverging air flow and 30 for contracting air flow.
- C. Provide engineered air foil blades turning vanes at square elbows, minimum 2 -1/2" wide, where shown on the drawings, and where changes in direction cannot be made as specified above. Turning vanes shall be installed inside the insulation on internally lined ducts.

- D. All rectangular sheet metal ducts over 18" in width shall be cross broken or mechanically beaded to reduce vibration. Reinforcing angle and stiffeners shall be provided where required to prevent sagging, buckling, vibration, sound transmission, etc.
- E. Changes in direction shall be made with easy flowing curves. The minimum center line radius of bends shall be at least 1-1/2 times the dimension of the duct in the plane of the turn unless otherwise shown. Radius type elbows fabricated with the inside radius equal to width of duct; short radius elbows will be permitted only by written approval of Architect/Engineer for specific cause.
- F. Ducts shall be fabricated to a minimum of SMACNA 2" pressure classification.
- G. All ducts shall be sealed to meet SMACNA Class B classification. Both longitudinal and transverse joints are to be sealed.

3.3 INSTALLATION OF ROUND DUCTWORK:

- A. Ducts shall be assembled so that they are free of obstructions, smooth on the inside and airtight.
- B. All branch takeoffs from trunk ducts shall be made with a cone shaped adapter to the trunk duct. The adapter shall be 2" more in dimension than the branch and shall taper to branch duct size with the side of the adapter not exceeding 15 degrees from the horizontal.
- C. In low pressure ductwork, spin-in fittings may be used for round branch take-offs from rectangular duct.

3.4 JOINTS:

- A. Dissimilar metals shall have a heavy coat of zinc primer applied at connection point to keep surfaces from direct contact with each other.

END OF SECTION 15891

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SECTION 15893 - FLEXIBLE DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 Specification sections apply to work of this Section
- B. The requirements of the following Division 15 sections apply to this section.
 - 1. "Basic Mechanical Requirements"
 - 2. "Basic Mechanical Materials and Methods"
 - 3. "Low Pressure Ductwork"

1.2 WORK DESCRIPTION:

- A. Furnish and install flexible duct connections of the size as shown or implied on the Contract Documents.
- B. Extent of the work is indicated on the Drawings and in the schedules, and by requirements of this section.

1.3 QUALITY ASSURANCE:

- A. The flexible duct shall have been tested by UL under Standard UL #181 and shall be listed as a "Flexible Air Duct Connector," Class I
- B. Construction Standards:
 - 1. All ducts shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards.
 - 2. Where SMACNA standards provide no guidance, comply with ASHRAE Handbook of Fundamentals chapter on Duct Construction.
 - 3. Comply with ANSI/NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

1.4 SUBMITTALS:

- A. Submit descriptive literature and shop drawings for manufactured products and factory fabricated flexible ductwork in accordance with Division 1 requirements.
- B. Complete dimensioned layouts of ductwork are required for sheetmetal ductwork. Indicate location of all flexible duct and fan connections.
- C. Indicate hanging and support details for flexible ductwork.

1.5 RECORD DRAWINGS:

- A. Submit Record Drawings in accordance with Division 1 requirements.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Protect flexible ductwork, accessories and purchased products from damage, dirt, and moisture during shipment, storage, and handling.
- B. Where possible, store flexible ductwork inside and protect from the weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Clevaflex
- B. Wiremold
- C. Flexmaster
- D. Thermaflex
- E. Norflex
- F. Atco
- G. Hart and Cooley

2.2 FLEXIBLE DUCT:

- A. Insulated, flexible ductwork shall be constructed having two tough plies of black polyester film encapsulating a galvanized steel helix. The covering shall be [XX] inch thick fiberglass of [XX] lb *[Specifier—insert site specific insulation thickness and density energy code requirements.]* density, with an airtight PVC skin serving as a vapor barrier.

2.3 FLEXIBLE CONNECTIONS

- A. Provide flexible fabric connections at suction and discharge connections of sheet metal ductwork with supply and exhaust fans, and other equipment employing such fans.
- B. Fabricate of 30 oz. "Ventglas," or equal, neoprene coated fabric properly secured by bolted angles or band iron. No metal to metal contact will be allowed.
- C. Flexible connection fabric shall be approved by the Underwriter's Laboratories, Inc., and comply with UL-191-1967.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Provide flexible duct where and noted on the Drawings. Lengths of flexible duct shall not exceed 6 feet and shall be continuously supported. Duct shall be supported from above at not to exceed 3'-0" o.c. and shall not lay on ceiling or light fixtures. Support flexible duct from integral grommet strip or minimum 1" sheetmetal bands per SMACNA figure 3-10.
- B. Ducts shall be installed in one continuous piece with no intermediate joints.
- C. Not more than 2 elbows shall be formed from flexible duct. Form additional elbows out of hard pipe. Install flexible duct connections.
- D. Connections at ductwork and terminals shall be airtight. Spin-in fittings may be used when connecting to rectangular ducts.
- E. When installing, insulation shall be pulled back and the core shall be securely taped with three wraps of pressure sensitive tape, and then banded with a corrosive resistant metal band. After banding, insulation and vapor barrier shall be replaced, taped, and sealed around duct connection.
- F. For low pressure duct connections, slip the flexduct over the collar and sheet metal screw through the duct and collar. Seal the joint with duct tape and an aluminum drawband.
- G. Do not pass through walls with flexible duct.
- H. Provide the flexible connections at ductwork connection to vibrating or rotating equipment, including fans.

END OF SECTION 15893

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SECTION 15900 – HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. See Division 12 Section “fire alarm” for fire and smoke detectors mounted in HVAC systems and equipment.

1.2 QUALITY ASSURANCE:

- A. Installer Qualifications: A qualified installer who is an authorized representative of the automatic control system manufacturer for both installation and maintenance of units required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 90A, “Installation of Air Conditioning and Ventilation Systems.”

1.3 COORDINATION

- A. Coordination location of thermostats, humidistats, and other exposed control sensors with plans and room details before installations.
- B. Coordination equipment with Division 13 Section “Fire Alarm” to achieve compatibility with equipment that interfaces with that system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. All DDC components located in the switchgear panels are furnished by the Owner through the Owner's OEM agent or through agreements with manufacturers.

2.2 CONTROL CABLE

- A. Electronic Cable for Control Wiring: as specified in Division 16 section “Control Signal Transmission media.”

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment level and plumb.
- B. Install raceways, sensors, and communication wiring as indicated on the Drawings.
- C. Expand list of locations below or clearly indicate on Drawings.
- D. Install electronic cables according to Division 16 Section “Control/Signal Transmission Media”

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 16 Section “Raceways and Boxes.”
- B. Install building wire and cable according to Division 16 Section “conductors and Cables.”

- C. Install signal and communication cable according to Division 16 Section "Control/Signal Transmission Media."
1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 2. Install cable in raceway.
 3. Bundle and harness multiconductor instruments cable in place of single cables where several cables follow a common path.
 4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 5. Number-code and color-code conductors for future identification and service of control system, except local individual room control cables.

END OF SECTION 15900

SECTION 15910 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. The following Division 15 Sections apply to this Section:
 - 1. "Basic Mechanical Requirements"
 - 2. "Basic Mechanical Materials and Methods"
 - 3. "Low Pressure Ductwork"
 - 4. "Flexible Ductwork"
 - 5. "Supports and Anchors"

1.2 CODE COMPLIANCE:

- A. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards - Metal and Flexible".
- B. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
- C. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

1.3 PRODUCT DATA:

- A. Submittals: Submit manufacturer's technical product data, shop drawings, and maintenance data for each type of ductwork accessory.
 - 1. Shop drawings shall include the following:
 - a. Access door installations.
 - b. Volume damper, turning vanes, and extractor installation, instructions, and fabrication.
- B. Maintenance Manuals:
 - 1. Provide maintenance manuals and operating instructions for fire dampers.

1.4 QUALITY ASSURANCE:

- A. Reference Standard:
 - 1. Access doors: United Sheet Metal type AW-1 and Air Balance model FSA-100
 - 2. Volume dampers: Young Regulator models 301, 443, and 656
 - 3. Turning vanes: Titus models Y and Z
 - 4. Louvers: Construction Specialties Inc A 4157
- B. Acceptable Manufacturers:
 - 1. Access doors: Air Balance, United Sheet Metal, American Warming, National Controlled Air.
 - 2. Volume dampers: Louvers and Dampers, Inc., Young, Titus, United, National Controlled Air, Air Balance.
 - 3. Turning vanes and extractors: Titus, Krueger, National Controlled Air.

4. Louvers: Ruskin, Construction Specialties, Louvers & Dampers, Inc., American Warming and Ventilating, Vent Products.

PART 2 - PRODUCTS

2.1 VOLUME DAMPERS:

- A. Opposed blade construction reduced.
- B. 5 inches by 1 inch by 16 gauge galvanized steel channel.
- C. 6 inches wide 16 gauge galvanized steel blades.
- D. Linkage concealed in frame.
- E. Locking device to hold damper in fixed position.
- F. Reference standard: Ruskin CD35.

2.2 GRAVITY BACKDRAFT DAMPERS:

- A. Extruded aluminum frame .090 inch wall thickness with felt edged perimeter.
- B. 0.025 inch formed aluminum blade with extruded vinyl edge seals.
- C. Zytel bearing.
- D. Counter balances adjustable for field balancing.
- E. 2 inch frame.
- F. Damper to be able to relieve air at pressure differentials less than .01 inch W.G.
- G. Reference Standard: Ruskin CBD2.

2.3 DUCT ACCESS DOORS:

- A. Low Pressure Rectangular Ductwork
 1. UL listed.
 2. One inch thick insulated 22 gauge galvanized steel door.
 3. 22 gauge galvanized steel frame having 5/8 inch knock over edges.
 4. Continuous aluminum hinge.
 5. Cam lock latch.
 6. 1/2 inch wide gasket.
 7. Square opening.

2.4 TURNING VANES:

- A. Duct turning vanes shall be dual radius type secured to steel side pieces, length as required for duct size; constructed in accordance with SMACNA Standards Plate 22 (Low Velocity).

2.5 FLEXIBLE CONNECTIONS:

- A. Flexible duct connections shall be UL listed neoprene coated double glass fabric; connections exposed to weather or other moisture conditions shall have a rubber exterior finish.

2.6 WALL LOUVERS:

- A. Rectangular Intake, Relief, and Exhaust Louvers - Aluminum - Stormproof
 1. Maximum pressure drop 0.2 inch w.g. at 1000 FPM free area velocity.

2. Expanded, flattened aluminum bird screen of 1/2 inch by .063 material tightly stretched and suitably braced to prevent sagging.
3. Frame shall be 4 inches deep and constructed of 6063T5 extruded aluminum of
4. 0.100 inch nominal wall thickness. Blades shall be constructed of 6063T5 extruded aluminum of .081 inch nominal wall thickness. The maximum blade length shall be 65 inches. Blades to be the drainable type set at minimum 37-1/2 inch degree angle. Sills and jambs shall be one piece structural members.
5. Corners to be mitered and continuously beliarc welded. Structural supports designed for 20 PSF wind load. Include provisions for expansion at jambs with slideable interlocked mullions. Fastenings shall be aluminum or stainless steel.
6. Include sills, mullion, sill extensions, and anchorages.
7. Finish type to be baked enamel, color as selected by Architect.
8. Shop drawings of louvers and colors must be approved by the Architect/Engineer before fabrication of louvers is started.
9. No dissimilar metals, which might induce electrolysis, shall be used in the construction, screenings, or mounting of the louvers.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. All ductwork accessories shall be fabricated and installed in accordance with the recommendation of the latest edition of ASHRAE Guide and Data Books and SMACNA Duct Construction Standards.
- B. Accessories:
 1. Volume dampers shall be installed at each branch duct connection to main or trunk duct; where shown on the Drawings; and elsewhere as required to provide for proper air distribution and balancing.
 2. Flexible connections shall be provided for every duct connection to equipment and as elsewhere shown on the Drawings. Connection shall be of sufficient length to eliminate vibration transmission.
 3. Anti-backdraft dampers shall be installed below each exhaust fan at roof in a position accessible from the roof.
 4. Turning vanes shall be installed in each supply duct at 90 elbows and elsewhere shown on the Drawings. Field fabricated turning vanes are not acceptable.
 5. Install wall louvers as denoted and detailed on the Drawings. Seal exterior louvers to building joints with an approved silicone clear sealant.
 - a. Sheet Metal Contractor to verify sizes of wall louvers required prior to ordering.
 - b. Ductwork (where required) shall be fastened completely to louver. Bottom of ductwork shall be sloped up minimum of 30 degrees toward inside of building to control entry of water. Seal joints with silicone or plastic sealant.
 - c. Provide masonry lintels for all louvers installed in masonry walls. Lintel shall extend minimum 12" beyond opening each end.

END OF SECTION 15910

SECTION 15941 - DIFFUSERS, REGISTERS, & GRILLES

PART 1 - GENERAL

1.1 WORK DESCRIPTION:

- A. Scope of Work:
 - 1. Furnish and install air distribution devices as shown and/or scheduled on the Contract Documents.
- B. Products Included (Reference Schedules on Mechanical Contract Drawings):
 - 1. Type "EG" - Exhaust Grille/Registers
 - 2. Type "PD" - Panel Diffusers
 - 3. Type "RG" - Return Grilles
 - 4. Type "SG" – Supply Grilles
 - 5. Type "TG" - Transfer Grilles
 - 6. Drop Box Diffusers

1.2 RELATED DOCUMENTS:

- A. General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications.
- B. Mechanical Contract Drawings.
- C. Related Mechanical Specification Sections:
 - 1. "Basic Mechanical Requirements"
 - 2. "Basic Mechanical Materials and Methods"
 - 3. "Low Pressure Ductwork"
 - 4. "Flexible Ductwork"
 - 5. "Ductwork Accessories"
 - 6. "Testing, Adjusting, and Balancing"

1.3 QUALITY ASSURANCE:

- A. Reference Standards:
 - 1. ADC Compliance: Test and rate registers, grilles, and diffusers in accordance with ADC Equipment Test Code 1062, provide Certified Ratings Seal on each unit.
 - 2. ARI Compliance: Test and rate registers, grilles, and diffusers in accordance with ARI Standard 650.
 - 3. NFPA Compliance: Construct and install air outlets and inlets in accordance with NFPA 90A-93.
 - 4. Diffuser, register, and grilles finishes must meet the requirements of ASTM 870 Water Immersion Test, ASTM D117 Corrosive Environments Salt Spray Test, and ASTM D-2794 Reverse Impact Cracking Test under 50 in-lb.

1.4 SUBMITTALS:

- A. Submit descriptive product literature and shop drawings in accordance with Section 01340 of the General Requirements.
 - 1. Submittals and shop drawings shall include the following:

- a. Dimensions
 - b. Materials of construction
 - c. Finish
 - d. Performance data
 - 1) Throw and drop
 - 2) Static-pressure drop
 - 3) Noise ratings
 - e. Accessories furnished
 - f. Mounting details
2. Submit a schedule of units which includes the following data for each unit:
- a. Unit designation
 - b. Room location
 - c. Model number
 - d. Unit size
 - e. Accessories furnished
3. Where specified herein, submit samples of diffusers, registers, and grilles of manufacturer's standard color and construction for review by the project Architect/Engineer.

PART 2 - PRODUCTS

2.1 EXHAUST GRILLES/REGISTERS "EG":

- A. Capacity, size, and pattern as noted on the Mechanical Contract Drawings.
- B. All steel construction.
- C. White, baked enamel finish.
- D. Maximum sound level NC-35.
- E. 35° or 45° fixed deflection blades spaced $\frac{3}{4}$ " on center, blades parallel to long dimension.
- F. 1-1/4" frame mounting with countersunk screwholes.
- G. Provide optional damper.
- H. Manufacturers:
 - 1. Anemostat S3HD
 - 2. Carnes RSLA
 - 3. Metal-Aire SRH
 - 4. Nailor Industries 6145H
 - 5. Krueger 80H
 - 6. Price 530/F/L/A
 - 7. Titus 350RL

2.2 SUPPLY DIFFUSERS "SD":

- A. Capacity, size, and pattern as noted on the Mechanical Contract Drawings.
- B. 24 gauge stamped steel construction.

- C. White, baked enamel finish.
- D. Maximum sound level NC-35.
- E. 24"x24" Panel style face with three square cones.
- F. Mounting suitable for lay-in acoustical ceiling.
- G. Provide optional inlet balance damper accessible from face of diffuser.
- H. Manufacturers:
 - 1. Anemostat EPL
 - 2. Carnes SFTB
 - 3. Krueger 1400
 - 4. Metal-Aire 5800
 - 5. Nailor Industries RNS
 - 6. Price SCD
 - 7. Titus TMS

2.3 RETURN GRILLES "RG":

- A. Capacity and size as noted on the Mechanical Contract Drawings.
- B. All aluminum construction.
- C. White, baked enamel finish.
- D. Aluminum perimeter frame with $\frac{1}{2}$ " X $\frac{1}{2}$ " X $\frac{1}{2}$ " aluminum core.
- E. Mounting suitable for lay-in acoustical ceiling.
- F. Manufacturers:
 - 1. Anemostat GC5
 - 2. Krueger EGC-5
 - 3. Metal- Aire CC5
 - 4. Nailor Industries 51EC
 - 5. Price 80/F/A
 - 6. Titus 50F

2.4 SUPPLY GRILLES "SG":

- A. Capacity and size as noted on the Mechanical Contract Drawings.
- B. All aluminum construction.
- C. White, baked enamel finish.
- D. Aluminum perimeter frame with $\frac{1}{2}$ " X $\frac{1}{2}$ " X $\frac{1}{2}$ " aluminum core.
- E. Mounting suitable for lay-in acoustical ceiling.
- F. Manufacturers:
 - 1. Anemostat GC5
 - 2. Krueger EGC-5
 - 3. Metal- Aire CC5
 - 4. Nailor Industries 51EC
 - 5. Price 80/F/A

6. Titus 50F

2.5 TRANSFER GRILLES "TG":

- A. Capacity, size, and pattern as noted on the Mechanical Contract Drawings.
- B. All steel construction.
- C. White, baked enamel finish.
- D. Maximum sound level NC-35.
- E. 35° or 45° fixed deflection blades spaced ¾" on center, blades parallel to long dimension.
- F. 1-1/4" frame mounting with countersunk screwholes.
- G. Manufacturers:
 - 1. Anemostat S3HD
 - 2. Carnes RSLA
 - 3. Krueger 80H
 - 4. Metal-Aire SRH
 - 5. Nailor Industries 6145H
 - 6. Price 530/F/L/A
 - 7. Titus 350RL

2.6 DROP BOX DIFFUSERS:

- A. Drop boxes shall be constructed of 18 gauge galvaneal steel with insulated air diverters. Diffusers shall be fully adjustable double deflection drum louvers. Provide duct transitions as required to complete the installation of drop boxes. Total pressure drop not to exceed 0.25" w.c.
- B. Finish: Drop boxes shall be prime and finish coated in the shop. Finish coating shall be color to match Pittsburgh Paints #2537 "Blossom White."
- C. Manufacturer: Subject to compliance with requirements and Section 01600, provide drop box diffusers and duct transitions from the following:
 - 1. AES Industries; Contact Paul Ledbetter (800) 786-0402

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Diffusers, registers, and grilles shall be installed per manufacturer's written recommendations.
- B. Secure all devices snug to ceiling. Support registers and grilles centered within acoustical ceiling tile from T-bars (not from pads), using horizontal channels secured to duct and
- C. T-bars.
- D. Diffuser, register, and grille locations as shown on the Drawings are approximate. Installation shall be in accordance with Architect's/Engineer's reflected ceiling plan.
- E. Install all registers and grilles with pattern controllers directed away from primary line of sight.
- F. All duct connections to supply, return, exhaust, and relief outlets shall be banded and taped.

END OF SECTION 15941

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SECTION 15990 - ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK DESCRIPTION:

A. Scope of Work:

1. Test, adjust, and balance the air moving equipment, and the air supply, return, and exhaust systems as herein specified.

B. Work Included:

1. Adjust fans and volume dampers to deliver, return or exhaust design air quantities to or from each space.
2. Adjust supply, return, and exhaust dampers.
3. Adjust individual outlets for proper air movement.

1.2 QUALITY ASSURANCE:

A. Acceptable Test and Balancing Agencies must be certified by NEBB.

B. Authorization of Report:

1. All reports shall be certified by an officer of the organization.

1.3 CONDITIONS:

A. System Operation:

1. Heating, ventilating, air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the adjusting and balancing work specified.

1.4 MEASUREMENTS:

A. Readjustments:

1. Should corrective measure caused by faulty installation require re-testing, adjusting and balancing, such work shall be done by the agency at no change in contract price.
2. Corrective measures that are required to be made to the installed work to provide proper balancing results shall be the responsibility of the Contractor.
3. New sheaves and belts required to produce the specified air volumes shall be furnished by the Contractor at no cost to Adjusting and Balancing Agency. Installation shall be by Adjusting and Balancing Agency under supervision of a representative of the equipment manufacturer.
4. Any new electric motors other than those scheduled that are required to obtain or accomplish design requirements are not a part of this contract.

PART 2 - PRODUCTS

2.1 INSTRUMENTS:

A. Quality:

1. The minimum instrumentation for testing, adjusting, and balancing shall be the "AABC Approved Minimum Field Instrumentation."
2. Instruments used for testing and balancing must have been calibrated within a period of six (6) months and checked for accuracy prior to start of work.

3. Instruments must be maintained and carried in such manner to protect them from excessive vibration and moisture conditions.

2.2 REPORTS:

A. Report Forms:

1. Submit specimen copies of report forms for approval prior to start of balancing work.
2. Reports shall be on standard forms similar to those published by the AABC or NEBB.

B. Final Report:

1. Upon completion, all information shall be neatly typed and five (5) copies submitted to the Architect/Engineer with accompanying schematic diagrams of systems tested.
2. All test reports shall be assembled, indexed, and submitted in vinyl covered loose-leaf notebooks with project name and Balancing Agency's name permanently printed thereon.

PART 3 - EXECUTION

3.1 PROCEDURE:

A. Methodology:

1. Testing and balancing shall be performed in complete accordance with National Standards for Field Measurements and Instrumentation.

3.2 PREPARATION:

A. Air System:

1. Prior to system testing and balancing:
 - a. Systems shall be fully operational.
 - b. All filters shall be clean.
 - c. Temperature and system controls shall be checked for proper operation.
 - d. Fan rotation shall be checked.

3.3 SYSTEMS BALANCE:

A. Air Systems:

1. Perform the following minimum test and balance:
 - a. Test and adjust supply, return, and exhaust fans to design requirements. Change sheaves and belts as required to obtain design air quantities.
 - b. Test and record motor electrical characteristics, RPM, service factor, measure voltage, full load amperes and connected load amperage. Check and record starter heaters sizes and rating, replacement belts sizes, etc.
 - c. Make pitot tube traverse (minimum of 16 point) of main supply ducts and obtain design CFM at fans. Seal all test holes with suitable hole plugs.
 - d. Test and record system static pressures, suction, and discharge.
 - e. Test and adjust system for design CFM recirculated air.
 - f. Test and adjust system for design CFM outside air.
 - g. Test and record entering air temperatures. (D.B. heating and cooling)

- h. Test and record entering air temperatures. (W.B. cooling)
- i. Test and record leaving air temperatures. (D.B. cooling)
- j. Test and record leaving air temperatures. (W.B. cooling)
- k. Adjust all main supply and return air ducts to proper design CFM.
- l. Adjust all zones to proper design CFM, supply, and return.
- m. Test and adjust each diffuser, grilles, and register to within 10% of design requirements.
- n. Each grille, diffuser, and register shall be identified as to location and area. Size, type, flow factor, and manufacturer of diffusers, grilles, registers, and all tested equipment shall be identified and listed.
- o. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, requirement CFM and test resultant CFM after adjustments.
- p. In cooperation with the Contractor's representative, setting adjustments of automatically operated dampers to operate as specified, indicated, and/or noted. The Balance Agency shall check all controls for proper calibrations and list all controls required adjustment by the Contractor.
- q. All diffusers, grilles, and registers shall be adjusted to minimize drafts in all areas.

3.4 RECORD DATA:

A. Air Systems:

- 1. Record the following minimum data:
 - a. CFM delivery and RPM of blowers and fans.
 - b. Static pressure at inlet and outlet of blowers and fans.
 - c. All equipment nameplate data.
 - d. Actual running current and voltage of fan motors.
 - e. CFM delivery or exhaust at each diffuser, register, or grille.

END OF SECTION 15990

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SECTION 16010 - GENERAL ELECTRICAL REQUIREMENTS

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 and to all following sections within Division 16.

1.2 SUMMARY

- A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.
- B. Division 16 of these Specifications, and Drawings numbered with prefixes E, generally describe these systems, but the scope of the electrical Work includes all such Work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing and Electrical Drawings and Specifications; and Addenda.
- C. Drawings are graphic representations of the Work upon which the Contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of Work, indicating the intended general arrangement of the equipment, fixtures, outlets and circuits without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.
- D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

1.3 QUALITY ASSURANCE

- A. Execute all Work under this Division in a thorough and professional manner by competent and experienced workmen duly trained to perform the Work specified.
- B. Install all Work in strict conformance with all manufacturers' requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.
- C. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. Provide all material and equipment of the same type from the same manufacturer whenever practicable.
- D. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

1.4 CODES, REFERENCES AND STANDARDS

- A. Execute all Work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the particular class of Work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes. Bring all conflicts observed between codes, ordinances, rules, regulations and these documents to the Architect's and Engineer's attention in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.
- B. If the conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Architect and Engineer, without additional compensation. Contractor will be held responsible for any violation of the law.
- C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.
- D. All material, manufacturing methods, handling, dimensions, methods of installation and test procedures shall conform to industry standards, acts, and codes, including, but not limited to the following, except where these Drawings and Specifications exceed them:
- | | |
|---------|---|
| IBC | International Building Code |
| ADA | Americans with Disabilities Act |
| AEIC | Association of Edison Illuminating Companies |
| ANSI | American National Standards Institute |
| ASTM | American Society of Testing Materials |
| AWS | American Welding Society |
| AWWA | American Water Works Association |
| CSA/USA | Canadian Standards Association/USA |
| ICEA | Insulated Conductors Engineers Association |
| IEEE | Institute of Electrical and Electronics Engineers |
| IES | Illuminating Engineering Society |
| NBFU | National Board of Fire Underwriters |
| NEC | National Electrical Code, NFPA 70 |
| NECA | National Electrical Contractors Association |
| NEMA | National Electrical Manufacturers' Association |
| NETA | International Electrical Testing Association |
| NFPA | National Fire Protection Association |
| OSHA | Occupational Safety and Health Act |
| UL | Underwriter's Laboratories |
- E. Comply with rules and regulations of public utilities and municipal departments affected by connections of services.
- F. Perform all electrical work in compliance with applicable safety regulations, including OSHA regulations. All safety lights, guards, and warning signs required for the performance of the electrical work shall be provided by the Contractor.
- G. Obtain and pay for all permits, licenses and fees that are required by the governing authorities for the performance of the electrical work.

1.5 DEFINITIONS

- A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:
1. Furnish: "To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."
 2. Install: "To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
 3. Provide: "To furnish and install complete, and ready for the intended use."
 4. Furnished by Owner (or Owner-Furnished) or Furnished by Others: "An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division."
 5. Engineer: Where referenced in this Division, "Engineer" is the Engineer of Record and the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions. When used in this Division, it means increased involvement by, and obligations to, the Engineer, in addition to involvement by, and obligations to, the "Architect".
 6. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
 7. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ, and standards that meet the specified criteria.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.
- C. Manufacturers: The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.
- D. The following definitions apply to excavation operations:
1. Additional Excavation: Where excavation has reached indicated sub-grade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
 2. Sub-base: as used in this Section refers to the compacted soil layer used in pavement systems between the sub-grade and the pavement base course material.
 3. Sub-grade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction from the Architect.

1.6 COORDINATION

- A. Coordinate with other Divisions for electrical work included in them but not listed in Division 16 or indicated on electrical Drawings.
- B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.
- C. Refer to Drawings and Divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing conduit in the manner anticipated in the design.
- D. Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed.
- E. Maintain an electrical foreman on the jobsite at all times to coordinate this Work with other trades so that various components of the electrical systems are installed at the proper time, fit the available space, and allow proper service access to all equipment. Carry on the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.
- F. Work of this Division shall progress according to the "Construction Schedule" as described in Division 01 and as approved by the Architect. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule so as to ensure successful achievement of all schedule dates.

1.7 MEASUREMENTS AND LAYOUTS

- A. The Drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

1.8 SUBMITTALS

- A. Refer to Division 01 and General Conditions for submittal requirements.
- B. Submittals and shop drawings shall not contain HEI's firm name or logo, nor shall it contain the HEI's engineers' seal and signature. They shall not be copies of HEI's work product. If the contractor desires to use elements of such product, the license agreement for transfer of information at the end of this section must be used.
- C. Assemble and submit for review, manufacturers' product literature for material and equipment to be furnished, installed, or both, under this Division, including shop drawings, manufacturers' product data and performance sheets, samples, and other submittals required by this Division. Provide the number of submittals required by Division 01; however, at a minimum, submit seven (7) sets.
- D. Separate submittals according to individual specification sections. Only resubmit those sections requested for resubmittal.

- E. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed.
- F. Refer to individual Sections for additional submittal requirements.
- G. Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittals, if required. Transmit submittals as soon as possible after Notice to Proceed and before construction starts.
- H. Before transmitting submittals and material lists, verify that the equipment submitted is mutually compatible with and suitable for the intended use. Verify that the equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.
- I. Submittals shall contain the following information. Submittals not so identified will be returned to the Contractor without action:
 - 1. The project name.
 - 2. The applicable Specification Section and paragraph.
 - 3. The submittal date.
 - 4. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
- J. Refer to Division 1 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 1. Contractor shall notify the Architect and Engineer that the shop drawings have been posted. If electronic submittal procedures are not defined in Division 1, Contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Architect and Engineer's designated representatives. Contractor shall allow the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.
- K. The Engineer's checking and subsequent acceptance of such submittals shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Engineer's and Architect's attention to such deviations at the time of submission, and secured written acceptance; nor shall it relieve him from responsibility for errors in dimensions, details, sizes of members, or quantities; or for omissions of components or fittings; or for not coordinating items with actual building conditions and adjacent work.

1.9 ELECTRONIC DRAWING FILES

- A. In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling fee of \$200 for a drawing set up to 12 sheets and \$15 per sheet for each additional sheet. Contact the Architect for Architect's written authorization. Contractor shall complete and send the form attached at the end of this section along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form. In addition to payment, Architect's written authorization and Engineer's release agreement form must be received before electronic drawing files will be sent.

1.10 SUBSTITUTIONS

- A. Refer to Bid documents, General and Supplementary Conditions and Division 01 Specification Sections for limitations and restrictions on substitutions.
- B. Materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.
- C. No substitutions will be considered with receipt of Bids, unless the Architect and Engineer have received from the Bidder a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids, and have approved the substitution request. Include, with each such request, the name of the material or equipment for which substitution is being requested, and a complete description of the proposed substitution, including drawings, cut sheets, performance and test data, and all other information necessary for an evaluation. Include also a statement setting forth changes in other materials, equipment or other work that would be required to incorporate the substitution. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's or Engineer's decision to approve or disapprove a substitution in a Bid is final.
- D. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal.
- E. No substitutions will be considered after receipt of Bids and before award of the Contract.
- F. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.11 OPERATION AND MAINTENANCE DATA

- A. Refer to Division 01 and General Conditions for Operation and Maintenance Data.
- B. Submit data prior to requesting the final punch list and before all requests for Substantial Completion.
- C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.
- D. Prior to Substantial Completion of the project, furnish to the Architect, for Engineer's review, and for the Owner's use, four (4) copies of brochures in three-ring, loose-leaf, hard-back notebook form, divided and tabbed, containing equipment data, approved submittals, shop drawings, diagrams, capacities, spare part numbers, manufacturers' service and maintenance data, warranties, guarantees, etc. Include local contacts complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.

1.12 SPARE PARTS

- A. Provide to the Owner the spare parts specified in the individual sections of this Division.

1.13 RECORD DRAWINGS

- A. Keep a set of jobsite work prints of the Issued for Construction Drawings on the jobsite during construction, for the purpose of annotating changes. During the course of construction, indicate on these Documents, changes made from the Conformed Contract Documents. Pay particular attention to those items that require locating for servicing.
- B. Refer to Division 01 and General Conditions for Record Drawings
- C. At the completion of the project, obtain reproducible vellum copies of the final Drawings and incorporate changes noted on the jobsite work prints onto these vellums. These changes shall be done by a skilled drafter. Mark each sheet "Record Drawing", along with the date, and deliver these Record Drawings to the Architect.

1.14 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 01 and General Conditions for Delivery, Storage and Handling.
- B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.
- C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and at all times, take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Architect and Engineer.
- D. Be responsible for the safe storage of tools, material and equipment.

1.15 WARRANTIES

- A. Refer to Division 01 and General Conditions for Warranties.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- C. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in these Construction Documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.
- D. Also warrant the following additional items:
 - 1. All raceways are free from obstructions, holes, crushing, or breaks of any nature.
 - 2. All raceway seals are effective.
 - 3. The entire electrical system is free from all short circuits and unwanted open circuits and grounds.
- E. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.
- F. Perform the remedial work promptly, upon written notice from the Architect or Owner.
- G. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.16 TEMPORARY FACILITIES

- A. Refer to Division 01 and General Conditions for Temporary Facilities requirements.
- B. Temporary Utilities: The types of services required include, but are not limited to, electricity, telephone, and internet. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.
- C. Construction Facilities: Provide facilities reasonably required to perform construction operations properly and adequately.

1. Enclosures: When temporary enclosures are required to ensure adequate workmanship, weather protection and ambient conditions required for the work, provide fire-retardant treated lumber and plywood; provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.
2. Heating: Provide heat, as necessary, to protect work, materials and equipment from damage due to dampness and cold. In areas where building is occupied, maintain a temperature not less than 65 degrees F. Use steam, hot water, or gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls. Use electric-resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable.

1.17 PROJECT CONDITIONS

- A. Conditions Affecting Excavations: The following project conditions apply:
 1. Maintain and protect existing building services that transit the area affected by work under this project.
 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
- B. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
- C. Use of explosives is not permitted.
- D. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits specified by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS AND MATERIALS

2.1 SOIL MATERIALS

- A. Sub base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, or natural or crushed sand.
- B. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve.
- C. Backfill and Fill Materials: Materials complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP; free of clay, rock, or gravel larger than two inches in any dimension; debris; waste; frozen materials; and vegetable and other deleterious matter.

PART 3 - EXECUTION

3.1 PERMITS

- A. Secure and pay for all permits required in connection with the installation of the Electrical Work. Arrange with the various utility companies for the installation and connection of all required utilities for this facility and pay all charges associated therewith including

connection charges and inspection fees, except where these services or fees are designated to be provided by others.

3.2 TEMPORARY ELECTRICAL SERVICE AND WIRING

- A. Provide 208Y/120 volt, three-phase, four-wire, temporary electrical service and temporary lighting system to facilitate construction.
- B. In existing facilities, with Owner's approval, Contractor may utilize the existing electrical system as the source of temporary power. Coordinate the point of connection and method of connection to the existing system with the Owner's Representative.
- C. Pay all charges made by the Electric Utility, with respect to installation and energy charges for temporary services.
- D. Work for the temporary power shall consist of all labor and materials, including, but not limited to conduit, wiring, panelboards, fuse blocks, fused disconnecting switches, fuses, pigtails, receptacles, wood panel switch supports, and other miscellaneous materials required to complete the power system.
- E. Install all temporary wiring in accordance with applicable codes, and maintain in an OSHA-approved manner.
- F. Provide an adequate number of GFCI type power distribution centers, rated 208Y/120V, four-wire, and not less than 60A, with sufficient fuse blocks or breakers for lighting and hand tool circuits, 60A four-wire feeders, all mounted within pre-fabricated enclosures UL listed for this application or on suitable wood panels bolted to columns or upright wood supports as required.
- G. Install circuits to points on each level of each building so that service outlets can be reached by a 50-foot extension cord for 120V power and a 100-foot extension cord for 208V power (or as required by OSHA or local authorities).
- H. Provide one lighting outlet per 30 linear feet of corridor and at least one light in each room and for every 800 square feet of floor area. Temporary lighting shall comply with OSHA requirements.
- I. If additional service is required for cranes, electrical welders or for electric motors over 1/2 HP per unit, such additional service shall become the responsibility of the trade involved.
- J. When the permanent wiring for lighting and power is installed, with approval of the Architect and Owner, the permanent system may be used, provided the Contractor assumes full responsibility for all electrical material, equipment, and devices contained in the systems and provided that roof drainage system and roofing are complete.
- K. When directed by the Architect, remove all temporary services, lighting, wiring and devices from the property.

3.3 EXISTING CONDITIONS

- A. Existing conditions indicated on the Drawings are taken from the best information available from the Owner, existing record drawings, and from limited, in-situ, visual site observations; and, they are not to be construed as "AS BUILT" conditions. The information is shown to help establish the extent of the new Work.
- B. Verify all actual existing conditions at the project site and perform the Work as required to meet the existing conditions and the intent of the Work indicated.

3.4 EXISTING UTILITIES

- A. Schedule and coordinate with the Utility Company, Owner and with the Architect all connections to, relocation of, or discontinuation of normal utility services from any existing utility line. Include all premium time required for all such work in the Bid.
- B. Repair all existing utilities damaged due to construction operations to the satisfaction of the Owner or Utility Company without additional cost.

- C. Do not leave utilities disconnected at the end of a workday or over a weekend unless authorized by representatives of the Owner or Architect.
- D. Make repairs and restoration of utilities before workmen leave the project at the end of the workday in which the interruption takes place.
- E. Include in Bid the cost of furnishing temporary facilities to provide all services during interruption of normal utility service.

3.5 EXCAVATION AND BACKFILLING

- A. Refer to Division 01, Division 02 and General Conditions for Excavation and Backfilling.
- B. Perform excavation of every description, of whatever substance encountered and to the depth required in connection with the installation of the work under this Division. Excavation shall be in conformance with applicable Divisions and sections of the Specifications.
- C. Restore roads, alleys, streets and sidewalks damaged during this Work to the satisfaction of Authorities Having Jurisdiction.
- D. Do not excavate trenches close to walks or columns without prior consultation with the Architect.
- E. Erect barricades around excavations, for safety, and place an adequate number of amber lights on or near the work and keep them burning from dusk to dawn. Be responsible for all damage that any parties may sustain in consequence of neglecting the necessary precautions in prosecuting the work.
- F. Slope sides of excavations to comply with local, state and federal codes and ordinances. Shore and brace as required for stability of excavation.
- G. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local, state and federal codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
 - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- H. Install sediment and erosion control measures in accordance with local codes and ordinances.
- I. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
 - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. In no case shall sewers be used as drains for such water.
- J. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
 - 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- K. Excavation for Underground Tanks and Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit

placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of one inch in diameter and larger with emulsified asphalt tree paint.
 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- L. Trenching: Excavate trenches for electrical installations as follows:
1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of six to nine inches clearance on both sides of raceway and cables.
 2. Excavate trenches to depth indicated or required for raceway and cables to establish slope, away from buildings and indicated elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
 3. Limit the length of open trench to that in which raceway and cables can be installed, tested, and the trench backfilled within the same day.
 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceway and cables. Provide a minimum of six inches of stone or gravel cushion between rock bearing surface and raceway and cables.
 5. Excavate trenches for raceway and cables and equipment with bottoms of trench to accurate elevations for support of raceway and cables on undisturbed soil.
- M. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- N. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
 2. Under building slabs, use drainage fill materials.
 3. Under raceway and cables, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 4. For raceway and cables less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of raceway and cables, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
 5. Other areas use excavated or borrowed materials.
- O. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.
- P. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

1. For vertical and diagonal raceway installations, thoroughly support raceways from permanent structures or undisturbed earth at no less than 10-foot intervals, while placing backfill materials, so that raceways are not deflected, crushed, broken, or otherwise damaged by the backfill placement.
- Q. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- R. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- S. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below:
1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - c. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- T. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.6 ACCESS TO EQUIPMENT

- A. Locate all pull boxes, junction boxes and controls so as to provide easy access for operation, service inspection and maintenance. Provide an access door where equipment or devices are located above inaccessible ceilings. Refer to Division 16 Section "Common Work Results for Electrical".
- B. Maintain all code required clearances and clearances required by manufacturers.

3.7 PENETRATIONS

- A. Unless otherwise noted as being provided under other Divisions, provide sleeves, box frames, or both, for openings in floors, walls, partitions and ceilings for all electrical work that passes through construction. Refer to Division 16 Section "Common Work Results for Electrical".

- B. Provide sleeves, box frames, or both, for all conduit, cable, and busways that pass through masonry, concrete or block walls.
- C. The cutting of new and/or existing construction will not be permitted except by written approval of the Architect.

3.8 CUTTING AND PATCHING

- A. Provide all necessary cutting of walls, floors, ceilings and roofs for work under this Division.
- B. Cut no structural member without permission from Architect.
- C. Patch around all openings to match adjacent construction.
- D. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Architect.

3.9 PAINTING

- A. Refer to Division 09 Section "Painting" for painting requirements.
- B. Paint exposed ferrous surfaces, including, but not limited to, hangers, equipment stands and supports using materials and methods as specified under Division 09 of the Specifications; colors shall be as selected by the Architect.
- C. Re-finish all field-threaded ends of galvanized conduits and field-cut ends of galvanized supports with a cold-galvanizing compound approved for use on conductive surfaces. Follow closely manufacturer's instructions for pre-cleaning surfaces and application.
- D. Factory finishes, shop priming and special finishes are specified in the individual equipment Specification sections.
- E. Where factory finishes are provided and no additional field painting is specified, touch up or refinish, as required by, and to the acceptance of, the Architect and Engineer, marred or damaged surfaces so as to leave a smooth, uniform finish. If, in the opinion of the Architect or Engineer, the finish is too badly damaged to be properly re-finished, replace the damaged equipment or materials at no additional costs to the Owner.

3.10 CLEANING

- A. Remove dirt and refuse, resulting from the performance of the Work, from the premises as required to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times.
- B. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from Work and assist in making the premises broom clean. Clean all material and equipment installed under this Division.
- C. Remove dirt, dust, plaster, stains, and foreign matter from all surfaces.
- D. Touch up and restore damaged finishes to their original condition.

3.11 ADJUSTING, ALIGNING AND TESTING

- A. Adjust, align and test all electrical equipment furnished and/or installed under this Division.
- B. Check motors for alignment with drive and proper rotation, and adjust as required.
- C. Check and test protective devices for specified and required application, and adjust as required.
- D. Check, test and adjust adjustable parts of all light fixtures and electrical equipment as required to produce the intended performance.
- E. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.

- F. After completion, perform tests for continuity, unwanted grounds, and insulation resistance in accordance with the requirements of NFPA 70 and NETA.
- G. Be responsible for the operation, service and maintenance of all new electrical equipment during construction and prior to acceptance by the Owner of the complete project under this Contract. Maintain all electrical equipment in the best operating condition including proper lubrication.
- H. Notify the Architect immediately of all operational failures caused by defective material, labor or both.
- I. Maintain service and equipment for all testing of electrical equipment and systems until all Work is approved and accepted by the Owner.
- J. Keep a calibrated voltmeter and ammeter (true RMS type) available at all times. Provide service for test readings when and as required.
- K. Refer to individual Sections for additional and specific requirements.

3.12 START-UP OF SYSTEMS

- A. Prior to start-up of electrical systems, check all components and devices, lubricate items appropriately, and tighten all screwed and bolted connections to manufacturers' recommended torque values using appropriate torque tools.
- B. Each power, lighting and control circuit shall be energized, tested and proved free of breaks, short-circuits and unwanted grounds.
- C. Adjust taps on each transformer for rated secondary voltages.
- D. Balance all single phase loads at each panelboard, redistributing branch circuit connections until balance is achieved to plus or minus 10 percent.
- E. Replace all burned-out lamps. Replace the lamps of all light fixtures that use incandescent, halogen or quartz lamp sources that are installed as part of the finished building, but are used by the Contractor during construction, with new lamps of appropriate type and wattage prior to turning the facility over to the Owner or Tenant.
- F. After all systems have been inspected and adjusted, confirm all operating features required by the Drawings and Specifications and make final adjustments as necessary.
- G. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.
- H. At the time of final review and tests of the power and lighting systems, all equipment and system components shall be in place and all connections at panelboards, switches, circuit breakers, and the like, shall be complete. All fuses shall be in place, and all circuits shall be continuous from point of service connections to all switches, receptacles, outlets, and the like.

3.13 TEST REPORTS

- A. Perform tests as required by these Specifications and submit the results in the operations and maintenance manuals. The tests shall establish the adequacy, quality, safety, and reliability for each electrical system installed. Notify the Architect and Engineer two working days prior to each test.
- B. For specific testing requirements of special systems, refer to the Specification section that describes that system.
- C. Upon completing each test, record the results, equipment type and ID number, Technician name & contact information, date and time of each test and the conditions under which the test was conducted. Submit to the Architect, for Engineer's review, in duplicate, the test results for the following electrical items:
 - 1. Building service entrance voltage and amperes at each phase.

2. Electrical service grounding conditions and grounding resistance.
 3. Proper phasing throughout the entire system.
 4. Voltages (phase-to-phase and phase-to-neutral) and amperes at each phase for each panelboard, switchboard, and the like.
 5. Phase voltages and amperes at each three-phase motor.
 6. Test all wiring devices for electrical continuity and proper polarity of connections.
- D. Promptly correct all failures or deficiencies revealed by these tests. Submit written documentation to Architect and Engineer noting that all deficiencies have been corrected.

3.14 SUBSTANTIAL COMPLETION REVIEW

- A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:
1. Submit complete Operation and Maintenance Data.
 2. Submit complete Record Drawings.
 3. Perform all required training of Owner's personnel.
 4. Turn over all spares and extra materials to the Owner, along with a complete inventory of spares and extra materials being turned over.
 5. Perform start-up tests of all systems.
 6. Remove all temporary facilities from the site.
 7. Comply with all requirements for Substantial Completion in the Division 01 and General Conditions.
- B. Request in writing a review for Substantial Completion. Give the Architect at least seven (7) days notice prior to the review.
- C. State in the written request that the Contractor has complied with the requirements for Substantial Completion.
- D. Upon receipt of a request for review, the Architect will either proceed with the review or advise the Contractor of unfilled requirements.
- E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items, he shall reimburse the Architect and Engineer for time and expenses incurred for the visit.
- F. Upon completion of the review, the Architect and Engineer will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.
- G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.
- H. Prior to requesting a final review, submit a copy of the final list of items to be completed or corrected. State in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

END OF SECTION 16010

AGREEMENT FOR TRANSFER OF INFORMATION
MACHINE-READABLE FORMAT

Project Name: _____ Project No./Phase: _____ Made this day, _____

By and Between Henderson Engineers, Inc., (hereinafter referred to as ENGINEER) and _____ (hereinafter referred to as RECIPIENT).

The enclosed electronic media are provided pursuant to your request for the purpose of production of shop drawings or record drawings. In using it, modifying it, or accessing information from it, you are responsible for confirmation, accuracy, and checking of the data from the media. ENGINEER hereby disclaims any and all responsibility from any results obtained in use of this electronic media and does not guarantee any accuracy of the information.

RECIPIENT agrees that it shall not use the information provided by ENGINEER for any purpose other than that described above without the express written consent of ENGINEER. RECIPIENT also hereby acknowledges that the data delivered by ENGINEER is for use by RECIPIENT only, and is not to be released to any other party without the written consent of the ENGINEER and does not transfer ownership of the instruments of professional service.

RECIPIENT understands that the automated conversion of information and data from the system and format used by ENGINEER to an alternate system or format cannot be accomplished without the possibility of introduction of inaccuracies, anomalies, and errors. In the event project documentation provided to RECIPIENT in machine readable form is so converted, RECIPIENT agrees to assume all risk associated therewith, and to the fullest extent permitted by law, to hold harmless and indemnify ENGINEER from and against all claims, liabilities, losses, damages, and costs, including but not limited to attorney's fees, arising therefrom or in connection therewith.

RECIPIENT recognizes that changes or modifications to ENGINEER'S instruments of professional service introduced by anyone other than ENGINEER may result in adverse consequences that ENGINEER can neither predict nor control. Therefore, and in consideration of ENGINEER'S agreement to deliver its instruments of professional service in machine readable format, RECIPIENT agrees, to the fullest extent permitted by law to hold harmless and indemnify ENGINEER from and against all claim, liabilities, losses, damages, and costs, including misuse or reuse by others of the machine readable information and data provided by ENGINEER under this Agreement. The foregoing indemnification applies, without limitation, to any use of the project documentation on another project, for additions to this project, or for completion of this project by others; ENGINEER may authorize excepting only such use in writing.

Send a check for shipping and handling costs in the amount of \$200 for an electronic drawing set up to 12 sheets plus \$15 per sheet in excess of 12 sheets payable to Henderson Engineers, Inc. along with completed and signed agreement and Architect's written authorization to receive electronic media. Be sure to indicate below the desired shipping method, format type and media type.

Sheet numbers requested: _____
1-12 sheets @ \$200 + _____ sheet(s) @ \$15 each = \$ _____ total due to Henderson Engineers, Inc.
Signature _____ Signature _____
HENDERSON ENGINEERS, INC. RECIPIENT

Date _____

Date _____

Shipping Method
☐ E-Mail
☐ First Class Mail
☐ FedEx Overnight (No P.O.Boxes)

Format
☐ AutoCAD
☐ DXF

Media
☐ CD-ROM
☐ DVD
☐ FLASH DRIVE
☐ DIRECT DOWNLOAD
Phone: _____

Shipping or E-Mail Address: _____

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SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. References to Codes and Standards listed in any Division 16 Specification refers to the most current release unless noted differently in the construction documents.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Supporting devices for electrical components.
 - 2. Utility components.
 - 3. Concrete equipment bases.
 - 4. Temporary facilities.

1.3 SUBMITTALS

- A. Product Data: For electricity-metering equipment including physical dimensions.
- B. Submittals shall contain the following information. Submittals not so identified will be returned to the Contractor without action:
 - 1. The project name.
 - 2. The applicable Specification Section and paragraph.
 - 3. The submittal date.
 - 4. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
- C. The Engineer's checking and subsequent acceptance of such submittals shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Engineer's and Architect's attention to such deviations at the time of submission, and secured written acceptance; nor shall it relieve him from responsibility for errors in dimensions, details, sizes of members, or quantities; or for omissions of components or fittings; or for not coordinating items with actual building conditions and adjacent work.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent.
- B. Install all equipment and materials in strict conformance with all manufacturers' requirements and recommendations, in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines, and with experienced workmen duly trained and licensed to perform the work specified.

1.5 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
- B. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."

1.6 DEFINITIONS

- A. The following list of words is defined to amplify their meaning whenever used on the electrical drawings, or in Division 16 of these specifications. These definitions supersede any other definitions, given or inferred by the General Conditions, Supplementary Conditions, or any dictionary standard definitions, for use in Division 16 only:
 - 1. Furnish: To supply (only) to another party for their use or installation, including all cost of delivery to the job site
 - 2. Install: To unload, distribute, uncrate, assemble and fix into the intended final positions, the installer to provide all miscellaneous hardware and supplies required to anchor an/or support securely, clean up, and dispose of rubbish
 - 3. Connect: To bring service(s) to point of installation and make all final connections of the service(s) to the installed equipment and provide all miscellaneous auxiliary appurtenances necessary to make operable for its intended final use.
 - 4. Provide: To furnish, install, and connect complete.
 - 5. Furnished by Owner (or Owner-Furnished) or Furnished by Others: "An item furnished by the Owner or under other Divisions or Contracts, and Install & Connect (per definitions above) under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch-diameter slotted holes at a maximum of 2 inches o.c., in webs.
 - 1. Channel Thickness: Selected to suit structural loading.

2. Fittings and Accessories: Products of the same manufacturer as channel supports.
 - D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
 - E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
 - F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
 - G. Expansion Anchors: Carbon-steel wedge or sleeve type.
 - H. Toggle Bolts: All-steel springhead type.
 - I. Powder-Driven Threaded Studs: Heat-treated steel.
 - J. Touchup paint for Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
 - K. Touchup for Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.
- 2.2 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING
- A. Provide the following metering equipment as shown on the Drawings:
 1. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
 2. Meter Sockets: Comply with requirements of electrical power utility company.
- 2.3 CONCRETE BASES
- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- 2.4 TEMPORARY FACILITIES
- A. Refer to Division 1 and General Conditions for Temporary Facilities requirements.
 - B. Temporary Utilities: The types of services required include, but are not limited to, electricity, telephone, and internet. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.
 - C. Construction Facilities: Provide facilities reasonably required to perform construction operations properly and adequately.
 1. Enclosures: When temporary enclosures are required to ensure adequate workmanship, weather protection and ambient conditions required for the work, provide fire-retardant treated lumber and plywood; provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.
 2. Heating: Provide heat, as necessary, to protect work, materials and equipment from damage due to dampness and cold. In areas where building is occupied, maintain a temperature not less than 55 degrees F. Use steam, hot water, or gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls. Use electric-

resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Obtain and pay for all permits, licenses and fees that are required by the governing authorities for the performance of the electrical work.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load for each support element.

3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1 inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar

hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Steel: Welded threaded studs or spring-tension clamps on steel.
 - 6. Field Welding: Comply with AWS D1.1.
 - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 UTILITY COMPANY AND METERING REQUIREMENTS

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.
- B. The Contractor shall make his own arrangements with the utility company for connection of the permanent utilities.
- C. The Contractor shall include all connection costs as part of the Work under his Contract.

3.5 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

3.6 CONCRETE BASES

- A. Construct concrete bases for all electrical floor mounted equipment, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- B. Construct light pole concrete bases per Structural Details.

3.7 TEMPORARY ELECTRICAL SERVICE AND WIRING

- A. Provide 208Y/120 volt, three-phase, four-wire, temporary electrical construction power and 480Y/277 volt, three-phase, four wire temporary lighting system to facilitate construction.

- B. Delete the following item if not an existing building, or if the Owner will not allow use of existing utilities.
- C. With Owner's approval, Contractor may utilize the existing electrical system as the source of temporary power. Coordinate the point of connection and method of connection to the existing system with the Owner's Representative.
- D. Choose only one of the two following items
- E. The Owner will pay all charges made by the Electrical Utility, with respect to installation and energy charges for temporary services.
- F. Work for the temporary power shall consist of all labor and materials, including, but not limited to conduit, wiring, panelboards, fuse blocks, fused disconnecting switches, fuses, pigtails, receptacles, wood panel switch supports, and other miscellaneous materials required to complete the power system.
- G. Install all temporary wiring in accordance with applicable codes, and maintain in an OSHA-approved manner.
- H. Provide an adequate number of GFCI type power distribution centers, rated 208Y/120V, four-wire, and not less than 100A, with sufficient fuse blocks or breakers for hand tool circuits, 100A four-wire feeders, all mounted within pre-fabricated enclosures UL listed for this application or on suitable wood panels bolted to columns or upright wood supports as required.
- I. Install circuits to points on each level of each building so that service outlets can be reached by a 100-foot extension cord for 120V power and a 100-foot extension cord for 208V power (or as required by OSHA or local authorities).
- J. For Office & Support Areas provide one lighting outlet per 30 linear feet of corridor and at least one light in each room and for every 800 square feet of floor office area. Temporary lighting shall comply with OSHA requirements.
- K. For Warehouse Area provide at least one light for every 3000 square feet of floor area. Temporary lighting shall comply with OSHA requirements.
- L. If additional service is required for cranes, electrical welders or for electric motors over 1/2 HP per unit, such additional service shall become the responsibility of the trade involved.
- M. When the permanent wiring for lighting and power is installed, with approval of the Architect and Owner, the permanent system may be used, provided the Contractor assumes full responsibility for all electrical material, equipment, and devices contained in the systems and provided that roof drainage system and roofing are complete.
- N. When directed by the Architect, remove all temporary services, lighting, wiring and devices from the property.

3.8 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.9 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Supporting devices for electrical components.
 - 2. Electricity-metering components.
 - 3. Concrete bases.

4. Electrical demolition.
5. Cutting and patching for electrical construction.
6. Touchup painting.
7. Excavation and Backfilling

3.10 EXCAVATION AND BACKFILLING

- A. Refer to Division 1, Division 2 and General Conditions for Excavation and Backfilling
- B. Perform excavation of every description, of whatever substance encountered and to the depth required in connection with the installation of the work under this Division. Excavation shall be in conformance with applicable Divisions and sections of the Specifications.
- C. Do not excavate trenches close to walks or columns without prior consultation with the Architect.
- D. Coordinate with Divisions 01 and 02 to determine what the actual requirements are, and modify the following as required so as to not contradict them. Edit out non-applicable items. If adequately covered therein, delete everything after "A" below, except, if there are vertical U/G raceway runs, keep the paragraph on raceway supports.
- E. Erect barricades around excavations, for safety, and place an adequate number of amber lights on or near the work and keep them burning from dusk to dawn. Be responsible for all damage that any parties may sustain in consequence of neglecting the necessary precautions in prosecuting the work.
- F. Slope sides of excavations to comply with local, state and federal codes and ordinances. Shore and brace as required for stability of excavation.
- G. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local, state and federal codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- H. Install sediment and erosion control measures in accordance with local codes and ordinances.
- I. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. In no case shall sewers be used as drains for such water.
- J. Trenching: Excavate trenches for electrical installations as follows:
 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of six to nine inches clearance on both sides of raceway and cables.
 2. Excavate trenches to depth indicated or required for raceway and cables to establish slope, away from buildings and indicated elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.

3. Limit the length of open trench to that in which raceway and cables can be installed, tested, and the trench backfilled within the same day.
 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceway and cables. Provide a minimum of six inches of stone or gravel cushion between rock bearing surface and raceway and cables.
 5. Excavate trenches for raceway and cables and equipment with bottoms of trench to accurate elevations for support of raceway and cables on undisturbed soil.
- K. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- L. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.
- M. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
1. For vertical and diagonal raceway installations, thoroughly support raceways from permanent structures or undisturbed earth at no less than 10-foot intervals, while placing backfill materials, so that raceways are not deflected, crushed, broken, or otherwise damaged by the backfill placement.
- N. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below:
1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - c. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
- 3.11 PERMITS, FEES, REGULATIONS, INSPECTIONS
- A. Contract shall arrange and pay for all permits, fees, and inspections required in connection with his work.
 - B. The Authority Having Jurisdiction (AHJ) shall inspect all work.
 - C. Certificate of Inspection shall be provided to the Engineer prior to application for Final Payment.

3.12 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 16050

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SECTION 16060 - GROUNDING AND BONDING

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes 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 Sections include the following:
 - 1. Section 16670 – Lightning Protection

1.3 REFERENCES

- A. Review the Drawings and all sections of the Specifications for equipment furnished by other Contractors and the Owner throughout the entire project.
- B. NFPA 70, NEC
- C. IEEE 1100 (Emerald Book) – IEEE Recommended Practice for Powering and Grounding Electronic Equipment.
- D. NECA 331 – Building and Service Entrance Grounding and Bonding.
- E. BICSI J-STD-607 – Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Ground rods.
 - 2. Grounding Connections
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- C. 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.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with U.L. 467 "Standard for Grounding and Bonding Equipment" for direct burial or embedment in concrete applications.
- C. Comply with NFPA 70 Article 250
- D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.
- E. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Erico Inc.; Electrical Products Group.
 - b. Boggs, Inc.
 - c. Hubbell.
 - d. Copperweld Corp.
 - e. Dossert Corp.
 - f. Erico Inc
 - g. FCI Burndy Products
 - h. Galvan Industries, Inc.
 - i. Harger Lightning Protection, Inc.
 - j. Hastings Fiber Glass Products, Inc.
 - k. Heary Brothers Lightning Protection Co.
 - l. Ideal Industries, Inc.
 - m. Cooper Power Systems.
 - n. Korns: C. C. Korns Co.; Division of Robroy Industries.
 - o. Lightning Master Corp.
 - p. Lyncole XIT Grounding.
 - q. O-Z/Gedney Co.; a business of the EGS Electrical Group.
 - r. Racor, Inc.; Division of Hubbell.
 - s. Robbins Lightning, Inc.
 - t. Salisbury: W. H. Salisbury & Co.
 - u. Superior Grounding Systems, Inc.
 - v. Thomas & Betts, Electrical.
 - w. Thompson Lightning Protection, Inc.
 - 2. Exothermic Connections
 - a. Erico Products
 - b. Southern Grounding
 - 3. High Pressure Compression Connections
 - a. FCI Burndy Products

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.

- C. 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.
- D. Grounding Electrode Conductors (conductors to a ground rod): Stranded cable.
- E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors may be used only for connection #6 ground wire to ground rod at light pole locations.
- C. Exothermic Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.
- D. High Pressure Compression Connectors:
 - 1. With associated specific dies
 - 2. Comply with IEEE 837
 - 3. As manufactured by Burndy "HYGROUND"
- E. Structural Steel Connectors
 - 1. With associated specific dies, and 2 bolt connections to a compression termination on the incoming grounding conductor.
 - 2. As manufactured by Burndy "GROUNDLINK", with not less than 8 square inches of contact surface per NFPA 780.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
 - 1. Size: 3/4 by 120 inches long per section.
 - 2. Where ground rods are identified greater than 10'0"-, use 3/4" by 120 inches with sectional ends.
- B. Test Wells: Provide handholes as specified in Division 2.

PART 3 - EXECUTION

3.1 APPLICATION

- A. In raceways, use insulated equipment grounding conductors.
- B. Connections: Use exothermic or compression for connections to structural steel and for underground connections, except those at test wells.
- C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- D. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- E. 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 4/0 bare copper conductor in 1" type PVC schedule 40 conduit in or under slab to connect to bus.
- F. Underground Grounding Conductors: Use copper conductor, 4/0 AWG. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Install equipment grounding conductors in all feeders and circuits.
- B. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- C. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- D. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- E. 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.

3.3 COUNTERPOISE

- A. Ground the steel framework of the building 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. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use

bare "rope-lay" construction copper conductor not less than 4/0 AWG for counterpoise and for tap to building steel. Bury counterpoise not less than 36 inches below grade and 24 inches from building foundation.

3.4 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 2 inches) below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. 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. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. 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. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. 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. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. 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.

3.5 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 No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous 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 according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- 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 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.

3.6 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Duct Banks: Install a grounding conductor with at least 50 percent ampacity of the largest phase conductor in the duct bank.
- B. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two 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 No. 2 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.

3.7 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.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and 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. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. 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. Describe measures taken to improve test results.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - e. Manhole Grounds: 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.8 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 16060

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SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on orange field.
 - 2. Legend: Indicates voltage and service.
- B. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend indicating type of underground line.
- D. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- E. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch-thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- F. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.
- G. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.

- H. Brass or Aluminum Tags: 2 by 2 by 0.05-inch metal tags with stamped legend, punched for fastener.

2.2 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.
- E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: According to color-coding.
- B. Paint: Formulated for the type of surface and intended use.
 - 1. Reference Division 9 for paint materials and specifications.

C. IDENTIFICATION LEGEND LABELS

- 1. Self-adhesive laminated label not less than 6" Tall by 6" Wide.
 - 2. Header: White all Capital Letters centered on black background: "NOTICE"
 - 3. Body: Black letters on white background.
 - 4. Text: Facility Cable Identification Legend:

	208 / 120 Volts	480/277 volts
Phase A:	Black	Brown
Phase B:	Red	Orange
Phase C:	Blue	Yellow
Grounded (Neutral):	White	Grey
Grounding:	Green	Green
Isolated Ground:	Green/yellow trace	N/A
 - 5. Apply label to the face of all electrical distribution equipment: panel boards and switchboards
- D. ARC FLASH HAZARD LABELS
- 1. Reference Specification Section 16573 Power Systems Analysis to perform an arc-flash incident energy study in accordance with IEEE 1584. Provide Arc Flash Labels for all effected electrical distribution equipment.

2. Self-adhesive laminated label not less than 4-1/4" Tall by 3-1/2" Wide
3. Standard label format that includes NFPA-70E required information for Arc Flash Hazard Analysis labels.
4. Contractor shall submit representative labels for approval prior to final production and placement by the Contractor. A label of each Category used on the project shall be submitted.
5. All electrical switchboards, equipment, panel boards and electrical disconnects greater than 30 Amps shall be labeled.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Install painted identification according to manufacturer's written instructions and as follows:
 1. Clean surfaces of dust, loose material, and oily films before painting.
 2. Prime surfaces using type of primer specified for surface.
 3. Apply one intermediate and one finish coat of enamel.
- E. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
 1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
 3. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Red.
 - b. Fire-Suppression Supervisory and Control System: Red and yellow.
 - c. Combined Fire Alarm and Security System: Red and blue.
 - d. Security System: Blue and yellow.
 - e. Mechanical and Electrical Supervisory System: Green and blue.
 - f. Telecommunication System: Green and yellow.
- F. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- G. Circuit Identification Labels on Boxes: Install labels externally.
 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 2. Concealed Boxes: Plasticized card-stock tags.

3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- H. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- I. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder and branch-circuit phase conductors:
 1. 208/120-V Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White
 - e. Ground: Green
 - f. Isolated Ground: Green with yellow continuous trace
 2. 480/277-V Conductors:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral: Gray
 - e. Ground: Green
 3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
- J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
 1. Legend: 1/4-inch-steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 2. Tag Fasteners: Nylon cable ties.
 3. Band Fasteners: Integral ears.
- K. Apply identification to conductors as follows:
 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.

2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- L. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- M. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch-high lettering on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures.
 2. Access doors and panels for concealed electrical items.
 3. Electrical switchboards.
 4. Emergency system boxes and enclosures.
 5. Motor-control centers.
 6. Disconnect switches.
 7. Enclosed circuit breakers.
 8. Motor starters.
 9. Push-button stations.
 10. Power transfer equipment.
 11. Contactors.
 12. Remote-controlled switches.
 13. Control devices.
 14. Transformers.
 15. Power-generating units.

END OF SECTION 16075

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SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 REFERENCES

- A. Review the drawings and all sections of the specifications for equipment furnished by other contractors and the owner throughout the entire project.
- B. UL Standard 44 - Requirements for single-conductor and multiple-conductor thermoset- insulated wires and cables.
- C. UL Standard 50 - Enclosures for electrical equipment intended to be installed and used in non-hazardous locations.
- D. UL Standard 83 - Requirements for 600 V, single-conductor, thermoplastic-insulated wires and cables.
- E. UL 486D - Sealed wire connector systems.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field Quality-Control Test Reports: From Contractor.

1.5 QUALITY ASSURANCE

- A. Wire and cable provided shall be NRTL certified and shall meet referenced requirements.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by manufacturers specified.

2.2 CONDUCTORS AND CABLES

- A. Manufacturers:
 - 1. Essex Group
 - 2. General Cable Corporation | Prysmian Group.
 - 3. Okonite Company.
 - 4. USA Wire & Cable.

- 5. Southwire Company.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- D. Conductor Insulation Types: Type THW THHN-THWN XHHW USE and SO complying with NEMA WC 5 or 7.
- E. Multiconductor Cable: Metal-clad cable, Type MC Type, and SO.
 - 1. Where MC cable is utilized, provide anti-short bushings at all locations in accordance with manufacturer's recommendations. Type BX or AC will not be considered equal to type MC by the Engineer.
- F. Aluminum conductors will be allowed as an acceptable alternative for feeders only, #1/0 and larger.

2.3 CONNECTORS AND SPLICES

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. AMP Incorporated/Tyco International.
 - 3. FCI/Burndy Products
 - 4. Hubbell/Anderson.
 - 5. IlSCO Corporation | ECM
 - 6. O-Z/Gedney; Emerson.
 - 7. 3M Company; Electrical Products Division.
- B. Connectors
 - 1. Connectors shall be factory-fabricated connectors of size, ampacity rating, material, type, and class for application and service indicated.
 - 2. Connectors shall be of the following types:
 - a. Solderless, uninsulated high conductivity, corrosion resistant, compression connectors conforming to UL 467
 - b. Insulated, indenter-type compression butt connectors
 - c. Insulated, integral self-locking flexible shell, expandable spring connectors
 - d. Uninsulated, indenter-type compression pigtail connectors
- C. Terminals: Welded-type connectors
 - 1. Terminals shall be factory-fabricated connectors of size, ampacity rating, material, type, and class for application and service indicated.
 - 2. Terminals shall be of the following types:
 - a. Solderless, uninsulated, high conductivity, corrosion resistant, compression terminals conforming to UL 467 and IEEE 837
 - b. Insulated, compression terminals
 - c. Solderless, high-conductivity, corrosion resistant, hex screw type, bolted terminals
 - d. Welded type terminals

2.4 OTHER SPLICING AND TERMINATING EQUIPMENT

- A. Products to be used in conjunction with Splices and Terminals listed above, not as the only means of Splicing.
- B. Shrinkable Tubing
 - 1. Subject to compliance with requirements of this Section, provide shrinkable tubing of the following types:
 - a. Either irradiated modified polyvinyl chloride or irradiated modified polyolefin heat shrinkable tubing.
 - b. Cold shrinkable tubing.
- C. Tapes and Sealers
 - 1. Vinyl Tapes shall be Flame-retardant, cold and weather-resistant, 3/4 inch or 1 1/2 inches wide, as required, and conforming to UL 510 and ASTM D 3005.
 - a. For interior, dry location, provide 7 mils, conforming to ASTM D 3005 (Type I); Scotch (3M) No. 33, or approved equal.
 - b. For exterior or damp and wet locations, provide 8.5 mils, conforming to ASTM D 3005 (Type II); Scotch (3M) No. 88, or approved equal.
 - 2. Rubber Tapes shall be Ethylene-propylene, rubber-based, 30-mil splicing tape, rated for 130° C operation; 3/4 inch and wider conforming to ASTM D 1373 and Federal Specification HH-I-553 (Grade A); Scotch (3M) No. 130C, or approved equal.
- D. Insulating Putty
 - 1. Insulating putty shall be rubber-based, 125-mil elastic filler putty; 1 1/2 inches wide; Scotch (3M) Scotchfil, or approved equal.
- E. Silicone Rubber Tapes
 - 1. Silicone Rubber Tapes shall be inorganic silicone rubber, 12-mil, 130° C rated, anti-tracking, self-fusing tape; 1 inch wide, Scotch (3M) No. 70, or approved equal.
- F. Sealer
 - 1. Sealer shall be liquid applied, fast-drying sealant; Scotch (3M) Scotchkote, or approved equal.

2.5 VOLTAGE DROP

- A. It is intended that the voltage drop shall not exceed 3% from the branch circuit panelboard to the last device.
- B. 120V Branch circuits over 120 feet in length shall be increased to #10 conductors. 120V Branch circuit over 200 feet in length shall be increased to #8 conductors.
- C. 277V Branch circuits over 170 feet in length shall be increased to #10 conductors. 277V Branch circuit over 250 feet in length shall be increased to #8 conductors.
- D. It is intended that the voltage drop shall not exceed 2% from the switchboard to the branch circuit panelboard. Contractor shall comply with the feeder paths shown on the Contract Drawings. Any deviation in routing shall be approved by the Engineer.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type THHN-THWN or XHHW, single conductors in raceway.

- B. Exposed Feeders: Type THHN-THWN or XHHW, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN or XHHW, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade: Type THHN-THWN or XHHW, single conductors in raceway.
- E. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC may be used where above joist line in warehouse areas.
- F. Branch Circuits Concealed in Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed above accessible ceilings: Type THHN-THWN, single conductors in raceway, Type MC may be used where above accessible ceiling in finished areas.
- H. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.
- I. Conductors for power application shall be not less than #12 AWG. #14, #16, #18 conductors may only be utilized for controls applications.
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- K. Fire Alarm Circuits: Type THHN-THWN, in raceway.
- L. Class 1 Control Circuits: Type THHN-THWN.
- M. Class 2 Control Circuits: Type THHN-THWN.

3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."
- G. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Splicing

1. Splicing and terminating shall be as specified in this Section. Details of special splicing and terminating shall be as shown on the Contract Drawings. Any splicing or terminating methods other than those specified below, for which the components are in accordance with the requirements of this Section, shall be submitted to the Engineer for approval
2. General Purpose Wires and Cables
 - a. Splices in dry locations for sizes #10 and smaller shall use one of the following:
 - 1) Insulated, integral, self-locking flexible shell, expandable spring connectors shall be applied to the twisted conductors. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.
 - 2) Compression type, insulated butt connectors shall be applied to the butted conductors by means of an appropriate crimping tool, providing controlled indentation. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.
 - 3) Compression type, pigtail connectors shall be applied to the conductors by means of an appropriate crimping tool, providing controlled indentation. The connector shall be covered with a polyamide cap and two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.
 - b. Splices in dry locations for sizes #8 and larger shall use all of the following:
 - 1) Connectors shall be split sleeve solderless type or solderless compression type.
 - 2) Fill indents of connectors with Scotchfil.
 - 3) Apply rubber splicing tape equal to the original insulation rating.
 - 4) Apply two, half-lapped layers of vinyl tape, or a shrinkable tubing
 - c. Splices in wet locations for all sizes
 - 1) Same as dry location specified above, with two coats of sealer or shrinkable tubing over the vinyl tape

E. Terminations

1. Terminations in dry locations for sizes #10 and smaller shall be with compression terminals, insulated or uninsulated
2. Terminations in dry locations for sizes #8 AWG through #3/0 AWG shall be either solderless uninsulated compression crimp type ring tongue terminals or bolted hex screw type ring tongue lugs.
3. Terminations in dry locations for sizes #4/0 AWG and larger shall be solderless, uninsulated compression crimp type ring tongue terminals.
4. Terminations in wet locations shall be as dry location terminations above, plus cover the entire termination area with two, half-lapped layers of vinyl tape and apply two coats of sealer over the tape.

3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
1. Test procedures used.
 2. Test results that comply with requirements.
 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 16120

SECTION 16130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Division 7 Section "Firestopping" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
 - 2. Division 16 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
 - 3. Division 16 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. LFMC: Liquidtight flexible metal conduit.
- D. RNC: Rigid nonmetallic conduit.
- E. RGS: Rigid Steel Conduit

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 GENERAL

A. Interior Outlet Boxes

1. Boxes shall be 4" square, minimum 2 1/8" deep, for up to two devices.
2. Provide single gang tile ring as required for single device applications.

B. Exterior Outlet Boxes

1. Provide corrosion-resistant, cast metal, weatherproof outlet box of types, shapes, sizes, depths as required for respective location.
2. For recessed in exterior wall application, provide galvanized sheet steel boxes with suitable depth.

2.3 METAL CONDUIT AND TUBING

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Electri-Flex Co.
4. Allied Tube and Conduit Div. | Atkore
5. Manhattan/CDT/Cole-Flex.
6. O-Z Gedney | Emerson
7. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1, UL-6 listed.

C. EMT and Fittings: ANSI C80.3, UL-797 listed

1. Fittings: Compression type.

D. FMC: Zinc-coated steel, UL-1

E. LFMC: Flexible steel conduit with PVC jacket, UL-360 listed

1. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.4 NONMETALLIC CONDUIT AND TUBING

A. Manufacturer:

1. American Pipe and Plastics Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp. | Audax Group
4. Cantex Inc.
5. North American Specialty Products.
6. Condux International.
7. Electri-Flex Co.
8. Lamson & Sessions; Carlon Electrical Products.
9. Manhattan/CDT/Cole-Flex.
10. RACO; Division of Hubbell, Inc.
11. AFC Cable Systems, Inc.

- 12. Thomas & Betts Corporation.
 - B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
 - C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- 2.5 EXPANSION FITTINGS
- A. Provide expansion fittings where conduits cross expansion joints. Expansion fittings shall provide a minimum of 4" movement and shall have tinned copper flexible braided jumper around the join. OZ Gedney Type EX or TX as required, with type BJ jumper, or equal.
- 2.6 SLEEVES
- A. Provide Schedule 40 pipe sleeve for conduits that penetrate:
 - 1. Fire Walls
 - 2. Foundation Walls
 - 3. Structural Floors (not slab on grade)
 - B. Sleeves shall be installed to 4" above finished floor.
 - C. Sleeve to be oversized as required to install OZ Gedney type CFSF fire seal through all floors and firewalls.
- 2.7 METAL WIREWAYS
- A. Manufacturers:
 - 1. Hoffman.
 - 2. Square D.
 - B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1.
 - C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
 - E. Wireway Covers: As indicated.
 - F. Finish: Manufacturer's standard enamel finish.
- 2.8 BOXES, ENCLOSURES, AND CABINETS
- A. Manufacturers:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. Emerson/General Signal; Appleton Electric Company.
 - 3. Erickson Electrical Equipment Co.
 - 4. Hoffman.
 - 5. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - 6. O-Z/Gedney; Unit of General Signal.
 - 7. RACO; Division of Hubbell, Inc.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet-PLM Division.
 - 10. Spring City Electrical Manufacturing Co.
 - 11. Thomas & Betts Corporation.

12. Walker Systems, Inc.; Wiremold Company (The).
 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. General
1. Interior Outlet Boxes
 - a. Boxes shall be 4" square, minimum 2 1/8" deep, for up to two devices.
 - b. Provide single gang tile ring as required for single device applications.
 2. Exterior Outlet Boxes
 - a. Provide corrosion-resistant, cast metal, weatherproof outlet box of types, shapes, sizes, depths as required for respective location.
 - b. For recessed in exterior wall application, provide galvanized sheet steel boxes with suitable depth.
- C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.9 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors:
 1. Exposed: Rigid steel RGS.
 2. Concealed: Rigid steel RGS.
 3. Underground, Single Run: RNC.
 - a. 90's to be RGS
 4. Underground, Grouped: RNC.
 - a. 90's to be RGS
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

6. Boxes and Enclosures: NEMA 250, Type 4.
- B. Indoors:
1. Exposed: RGS.
 2. Concealed: EMT.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
 4. Damp or Wet Locations: Rigid steel conduit.
 5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. EMT: Use compression fittings.
- 3.2 INSTALLATION
- A. 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.
 - B. Complete raceway installation before starting conductor installation.
 - C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
 - D. Install temporary closures to prevent foreign matter from entering raceways.
 - E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
 - F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
 - G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
 - H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 2. Space raceways laterally to prevent voids in concrete.
 3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 4. Change from RNC to rigid steel conduit, before rising above the floor.
 - I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 1. Run parallel or banked raceways together on common supports.

2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- J. Join raceways with fittings designed and approved for that purpose and make joints tight.
 1. Use insulating bushings to protect conductors.
- K. Tighten set screws of threadless fittings with suitable tools.
- L. Terminations:
 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- M. 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.
- N. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-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.
- P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- Q. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- S. Set floor boxes level and flush with finished floor surface.
- T. Set floor boxes level. Trim after installation to fit flush with finished floor surface.
- U. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 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.

3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 16130

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SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.
 - 2. Single- and double-pole snap switches and dimmer switches.
 - 3. Device wall plates.
 - 4. Pin and sleeve connectors and receptacles.
 - 5. Floor service outlets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.
- D. RFI: Radio-frequency interference.
- E. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc. | Hubbell
 - b. Cooper Wiring Devices
 - c. Hubbell Incorporated; Wiring Device-Kellems.
 - d. Leviton Mfg. Company Inc.
 - e. Pass & Seymour/Legrand; Wiring Devices Div.
 - 2. Wiring Devices for Hazardous (Classified) Locations:
 - a. Crouse-Hinds Arrow Hart Wiring Devices | Eaton
 - b. EGS/Appleton Electric Company | Emerson
 - c. Killark Electric Manufacturing Co. | Hubbell Incorporated.
 - 3. Floor Service Outlets:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Low Electric Fittings Company

2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Device shall be side and back wired, suitable for up to and including #10 branch circuit conductors.
 - 1. Bryant 5362
 - 2. Cooper Wiring Devices 5362
 - 3. Hubbell HBL 5362
 - 4. Leviton 5362
 - 5. Pass & Seymour 5362A
- B. GFCI Receptacles: Straight blade, feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter. Device shall be side and back wired, suitable for up to and including #10 branch circuit conductors.
- C. Isolated-Ground Receptacles: Straight blade, Heavy-Duty grade, duplex receptacle, with equipment grounding contacts connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Devices to be Listed and labeled as isolated-ground receptacles. Isolation shall be Integral to receptacle construction and not dependent on removable parts. . Device shall be side and back wired, suitable for up to and including #10 branch circuit conductors. Devices to be Orange in color.
 - 1. Bryant 5362-IG
 - 2. Cooper Wiring Devices IG-5362
 - 3. Hubbell IG-5362
 - 4. Leviton 5362-IG

- 5. Pass & Seymour IG6300
 - D. Industrial Heavy-Duty Pin and Sleeve Devices: Comply with IEC 309-1.
 - E. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.
- 2.3 PENDANT CORD/CONNECTOR DEVICES
- A. Description: Matching, locking-type plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.
 - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.
- 2.4 CORD AND PLUG SETS
- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.
- 2.5 SWITCHES
- A. Single Pole Switches: Comply with DSCC W-C-896E and UL 20. Device shall be side and back wired, suitable for up to and including #10 branch circuit conductors.
 - 1. Bryant 4901
 - 2. Cooper Wiring Devices 2221
 - 3. Hubbell HBL1221
 - 4. Leviton 1221-1
 - 5. Pass & Seymour 20AC1
 - B. Three Way Switches: Comply with DSCC W-C-896E and UL 20. Device shall be side and back wired, suitable for up to and including #10 branch circuit conductors.
 - 1. Bryant 4903
 - 2. Cooper Wiring Devices 2223
 - 3. Hubbell HBL1223
 - 4. Leviton 1223-1
 - 5. Pass & Seymour 20AC3
 - C. Four Way Switches: Comply with DSCC W-C-896E and UL 20. Device shall be side and back wired, suitable for up to and including #10 branch circuit conductors.
 - 1. Bryant 4904
 - 2. Cooper Wiring Devices 2224
 - 3. Hubbell HBL1224
 - 4. Leviton 1224-1
 - 5. Pass & Seymour 20AC4

2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: high-impact nylon.
 - 3. Material for Unfinished Spaces and Warehouse: galvanized steel-gray.
 - 4. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.7 FLOOR SERVICE FITTINGS

- A. Box Type: Deep Rectangular Cast Iron.
 - 1. Single Gang: Hubbell B2436
 - 2. 2 Gang: Hubbell B4233
 - 3. 3 Gang: Hubbell B4333
 - 4. Equals by Lew Electric Fittings Company
- B. Cover Type: Brass Covers
 - 1. Combination: Hubbell S2425
 - 2. Single Receptacle: Hubbell S3425
 - 3. Duplex Receptacle with flaps: S3825
 - 4. Equals by Lew Electric Fittings Company
- C. Compartments: Barrier separates power from voice and data communication cabling.
- D. Service Plate: Solid brass with satin finish.
- E. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- F. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable.

2.8 FINISHES

- A. Color:
 - 1. Wiring Devices Connected to Normal Power System:
 - a. Unfinished and Warehouse: Ivory.
 - b. Finished areas: Ivory.
 - c. Office areas: Ivory.
 - 2. Wiring Devices Connected to Emergency Power System: Red.
 - 3. Isolated-Ground Receptacles: Orange.
 - 4. Plates for Wiring Devices
 - a. Unfinished and Warehouse: Galvanized..
 - b. Finished areas: Ivory.
 - c. Office areas: Ivory.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.
- C. Remove wall plates and protect devices and assemblies during painting.
- D. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 16 Section "Electrical Identification."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 16140

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SECTION 16145 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Photoelectric switches.
 - 2. Switch-box occupancy sensors.
 - 3. Multipole contactors.
- B. Related Sections include the following:
 - 1. Division 16 Section "Wiring Devices" for wall-box dimmers and manual light switches.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
 - 2. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers:
 - 1. Intermatic, Inc.
 - 2. TORK | NSI Industries
- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 - 2. Time Delay: 15-second minimum, to prevent false operation.
 - 3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
 - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

2.4 SWITCH-BOX OCCUPANCY SENSORS

- A. Manufacturers:
 - 1. Bryant Electric; a Hubbell Company.
 - 2. Hubbell Lighting Inc.
 - 3. Leviton Mfg. Company Inc.
 - 4. Lightolier Controls; Signify
 - 5. Lithonia Lighting.
 - 6. MYTECH Corporation | Hubbell
 - 7. Novitas, Inc.
 - 8. RAB Electric Manufacturing, Inc.
 - 9. Sensor Switch, Inc.
 - 10. TORK | NSi Industries
 - 11. Unenco Electronics; a Hubbell Company.
 - 12. Watt Stopper | Legrand
- B. Description: PIR type with integral power-switching contacts rated for 800 W at 120-V ac, suitable for LED light fixtures or 1/4-hp motors; and rated for 2700 VA at 277-V ac, suitable for LED light fixtures
 - 1. Include ground wire.
 - 2. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keeps lighting off when selected lighting level is present.

2.5 INDOOR OCCUPANCY SENSORS

- A. Manufacturers:

1. Hubbell Lighting Inc.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting.
 4. MYTECH Corporation | Hubbell
 5. Novitas, Inc.
 6. RAB Electric Manufacturing, Inc.
 7. Sensor Switch, Inc.
 8. TORK | NSi Industries
 9. Unenco Electronics; a Hubbell Company.
 10. Watt Stopper | Legrand
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keeps lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in.
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.
- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on an 8-foot- high ceiling.
 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.6 MULTIPOLE CONTACTORS

- A. Manufacturers:
1. ASCO Power Technologies, LP | Schneider Electric Co.
 2. Cutler-Hammer; Eaton Corporation.
 3. GE Industrial Systems; Total Lighting Control.
 4. Siemens Energy and Automation
 5. Square D Company | Schneider Electric Co.
- B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Control-Coil Voltage: Match control power source.
 3. Provided with a 2-wire control option, similar to Square D R6, that allows a maintained contact to be utilized at the time clock.

2.7 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 16 Section "Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 16 Section "Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 16 Section "Conductors and Cables."
- D. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Division 16 Section "Voice and Data Communication Cabling."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 16 Section "Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 16 Section "Electrical Identification."
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 16145

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SECTION 16289 – SURGE PROTECTIVE DEVICES (SPDS) (1 KV AND LESS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes Surge Protective Devices (SPDS) for low-voltage power equipment.

1.3 REFERENCES

- A. Review the Drawings and all sections of the Specifications for equipment furnished by other Contractors and the Owner throughout the entire project.
- B. ANSI/NECA 1 - Good Workmanship in Electrical Contracting.
- C. ANSI/IEEE C62.41.1, C62.41.2, and C62.45.
- D. UL 1283 Listed.
- E. UL 1449 - Surge Protective Devices (SPDs).
- F. NFPA 70/NEC Article 242 - Surge Protective Devices (SPDs) – 1 kV or Less.
- G. NEMA LS-1.

1.4 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Provide verification that the SPD complies with the required ANSI/UL 1449 current Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum, model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).
- C. For side mount mounting applications (SPD mounted external to electrical assembly), provide electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration
- D. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
 - 1. UL 1283.
 - 2. UL 1449.
- E. Field quality-control test reports, including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Failed test results and corrective action taken to achieve requirements.

- F. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- G. Warranties: Special warranties specified in this Section.
- H. Fuse Documentation
 - 1. The installation instruction shall clearly indicate if the system requires an external overcurrent device to maintain the system U.L 1449 listing
 - a. A U.L. 1449 stipulation, signed by the manufacturer's authorized representative, is required for all submittals. The stipulation shall:
 - 1) Certify that the TVSS system is UL 1449 listed.
 - 2) Indicate if external overcurrent protection is required to maintain the UL 1449 listing.
 - 3) Indicate what internal fusing, if any, is incorporated in the TVSS system and what impact the fusing has on the performance of the device. (I.e. surge capacity and clamping levels).
 - b. If it is found that units after they are installed are not in strict accordance with this Specification, the Designer shall have the authority to order and have installed a suitable suppressor to meet these Specifications. Charges incurred to make these changes shall be regarded as a deduction from the Contractor's quoted price on the total project.

1.6 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Obtain suppression devices and accessories through one source from a single manufacturer.
 - 2. Manufacturer: Company specializing in manufacturing the products specified in this section with a minimum of five (5) years experience.
- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- E. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- F. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."

1.7 PROJECT CONDITIONS

- A. Placing into Service: Do not energize or connect service entrance equipment to their sources until the surge protective devices are installed and connected.
- B. Service Conditions: Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg.

3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet above sea level.

1.8 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.9 WARRANTY

- A. 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. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.

1.10 EXTRAMATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Advanced Protection Technologies, Inc. (APT), ASCO | Schneider Electric
 2. Current Technology, Inc. | ABB
 3. Innovative Technologies | Eaton
 4. LEA International.
 5. Liebert Corporation – Control Concepts; a division of Emerson.
 6. Square D Company | Schneider Electric

2.2 GENERAL CONSTRUCTION

- A. General Construction and Features:
 1. UL Listing: All SPDs shall bear the UL Mark and be Listed to the most recent editions of UL 1449 and UL 1283.
 2. Type Ratings: All SPDs installed on the line side of a service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of a service entrance disconnect shall be Type 1 or Type 2 SPDs.
 3. All SPDs shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.
 4. Suppressors shall be solid-state parallel type device designed for the system voltage operating bi-directionally and suppressing both positive and negative impulses. Devices must have suppression elements across all modes specified.
 5. SCCR: SPDs shall be UL labeled with a 200kA Short Circuit Current Rating (SCCR) unless otherwise indicated. Suppressor shall not require the use of any upstream overcurrent protection to obtain said rating.

6. Protection Modes: SPDs to provide line to line, line to neutral, each line to ground, and neutral to ground protection modes.
7. Nominal Discharge Current (In): All SPDs applied to the distribution system shall have a minimum In rating of 20kA regardless of their SPD Type (includes Types 1 and 2) or operating voltage.
8. MCOV: SPDs shall provide the following Maximum Continuous Operating Voltage (MCOV) of all suppression components utilized in the unit:
9. VPR: Suppressors shall have the following UL 1449 Voltage Protection Ratings (VPRs):

	480Y/277 V	208Y/120 V	600Y/347 V
Line to Neutral	1200	700	1500
Line to Ground	1200	700	1500
Neutral to Ground	1200	700	1500

10. Suppressor shall be capable of protecting against and surviving a minimum of 1000 ANSI/IEEE C62.41 Category C surges without failure or degradation of UL 1449 Third Edition surge rating by more than 10 percent.
11. EMI-RFI Filtering: SPDs to include EMI-RFI filtering with active tracking providing attenuation up to -50 dB from 100 kHz to 100 MHz.
12. SPD Mounting: SPDs mounting arrangements shall be as follows:
 - a. Separately Mounted Outboard: SPDs shall be separately mounted outboard in the following locations:
 - 1) All new switchboards where indicated on single line drawings.
 - 2) All new panelboards where indicated on single line drawings.
13. Enclosures: NEMA-250, with type matching the enclosure of panel or device being protected.

2.3 SERVICE ENTRANCE SUPPRESSORS – TYPE 1

- A. Provide products by one of the following:
 1. Current Technology – CG Plus 200
 2. LEA International – PV400
 3. Liebert (Control Concepts) LM200
- B. Rated and tested for Category C3 (20 kV, 10 kA, 8 by 20 microsecond waveform) as defined by ANSI/IEEE C62.41.
- C. Surge Protection Device Description: Sine-wave-tracking type with the following features and accessories:
 1. The system protection modules shall contain an array of balanced metal oxide varistor (MOV) array that provides differential mode to neutral and common mode to ground diversion of transient I²T energy.
 2. Each MOV will be individually fused.
 3. The TVSS shall be capable of withstanding over 10,000 sequential 10,000 Amp ANSI/IEEE C62.41 Category C3 impulses without degradation or failure.
 4. Primary transient path wiring shall be of #8 AWG copper minimum or via bus bar of equivalent capacity to provide equal impedance interconnection between phases.

5. Each protection module shall have a visual indicator that signifies the protection circuitry is on line. A redundant status indicator shall be mounted on the front of the panel. Each protection module shall be field replaceable.
6. The unit shall be U.L. Listed as an electromagnetic interference filter. Unit shall provide attenuation against EMI/RFI noise up to 50 dB at 1MHz.
7. The Suppressed Voltage Rating (SVR) shall be in conformance with U.L. 1449 Second edition as follows:
 - a. Voltage Application 208/120V
 - 1) Line to Neutral: 400V
 - 2) Line to Ground: 400V
 - 3) Neutral to Ground: 400V
 - b. Voltage Application 480/277V
 - 1) Line to Neutral: 800V
 - 2) Line to Ground: 800V
 - 3) Neutral to Ground: 800V
8. The construction of the unit shall be such that: individual components can be field replaced. The Engineer will not accept suppressors that require that the entire unit be removed, "sent in", and replaced.
9. The following is a listing of not acceptable construction features:
 - a. The Engineer will not accept plug-in component modules in the primary transient path.
 - b. The Engineer will not accept equipment that creates a hazard upon failure, such as a TVSS integral to the electrical distribution equipment.
 - c. The Engineer will not accept suppressors that rely on other external or upstream units to achieve the required performance and UL 1449 listing.
 - d. The Engineer will not accept suppressors that employ cartridge fuses or surge rated fuses.
10. Options
 - a. The following is a list of accessories that shall be provided:
 - 1) Summary alarm with dry contacts to provide summary status of TVSS module integrity. Alarm shall have one form C dry contact (1 N.O. and 1 N.C.) to provide remote monitoring of TVSS modules.
 - 2) Digital surge counter to provide six (6) digit counter to count transient voltage events as they occur on the phases. Counter shall have battery backup to retain the recorded number of events.
 - 3) Audible alarm with alarm disable switch to provide audible alarm to indicate module failure. Alarm shall have visual indication that the alarm is disabled.
 - 4) Disconnecting means to provide an integral interlocking non-fused disconnect switch.

2.4 PANELBOARD SUPPRESSORS – TYPE 2

- A. Provide products by one of the following:

1. Current Technology – CG Plus 80
 2. LEA International – LS200 Plus
 3. Liebert (Control Concepts) LM80
- B. Surge Protection Device Description: Sine-wave-tracking type with the following features and accessories:
1. The system protection modules shall contain an array of balanced metal oxide varistor (MOV) that provides differential mode to neutral and common mode to ground diversion of transient I²t energy.
 2. Each MOV will be individually fused.
 3. The TVSS shall be capable of withstanding over 10,000 sequential 10,000 Amp ANSI/IEEE C62.41 Category C3 impulses without degradation or failure.
 4. Primary transient path wiring shall be of #8 AWG copper minimum or via bus bar of equivalent capacity to provide equal impedance interconnection between phases.
 5. Each protection module shall have a visual indicator that signifies the protection circuitry is on line. A redundant status indicator shall be mounted on the front of the panel. Each protection module shall be field replaceable per phase.
 6. The unit shall be U.L. Listed as an electromagnetic interference filter. Unit shall provide attenuation against EMI/RFI noise up to 50 dB at 1MHz.
 7. The Suppressed Voltage Rating (SVR) shall be in conformance with U.L. 1449 Second edition as follows:
 - a. Voltage Application 208/120V
 - 1) Line to Neutral: 400V
 - 2) Line to Ground: 400V
 - 3) Neutral to Ground: 400V
 - b. Voltage Application 480/277V
 - 1) Line to Neutral: 800V
 - 2) Line to Ground: 800V
 - 3) Neutral to Ground: 800V
 8. The construction of the unit shall be such that: individual components can be field replaced. The Engineer will not accept suppressors that require that the entire unit be removed, "sent in", and replaced.
 9. The following is a listing of not acceptable construction features:
 - a. The Engineer will not accept plug-in component modules in the primary transient path.
 - b. The Engineer will not accept equipment that creates a hazard upon failure, such as TVSS that is integral to the electrical distribution equipment. The Engineer will not accept suppressors that rely on other external or upstream units to achieve the required performance and UL 1449 listing.
 - c. The Engineer will not accept suppressors that employ cartridge fuses.
 10. Options
 - a. The following is a list of accessories that shall be provided:

- 1) Summary alarm with dry contacts to provide summary status of TVSS module integrity. Alarm shall have one form C dry contact (1 N.O. and 1 N.C.) to provide remote monitoring of TVSS modules.
- 2) Digital surge counter to provide six (6) digit counter to count transient voltage events as they occur on the phases. Counter shall have battery backup to retain the recorded number of events.
- 3) Audible alarm with alarm disable switch to provide audible alarm to indicate module failure. Alarm shall have visual indication that the alarm is disabled.
- 4) Disconnecting means to provide an integral interlocking non-fused disconnect switch.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install Type 1 devices at switchboard on load side, with ground lead bonded to service entrance ground.
- B. Install Type 2 devices for panelboard with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 1. Provide multipole circuit breaker as shown on the One Line Diagram as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 1. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements.
 2. Complete startup checks according to manufacturer's written instructions.
 3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.19. Certify compliance with test parameters.
- B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain surge protective devices.
 1. Train Owner's maintenance personnel on procedures and schedules for maintaining suppressors.
 2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 16289

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
 - 1. Feeder and branch-circuit protection.
 - 2. Motor and equipment disconnecting means.
- B. Related Sections include the following:
 - 1. Division 16 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
 - 2. Division 16 Section "Fuses" for fusible devices.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- C. Field Test Reports: Submit written test reports and 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.
- D. Manufacturer's field service report.
- E. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
 - 1. Routine maintenance requirements for components.
 - 2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
 - 3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA AB 1 and NEMA KS 1.

C. Comply with NFPA 70.

1.6 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.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spares: For the following:
 - a. Fuses for Fused Switches: Per Section 16491.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fusible Switches:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Control Division.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D Co.
2. Molded-Case Circuit Breakers:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Control Division.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D Co.

2.2 ENCLOSED SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

2.3 ENCLOSED CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 6. GFCI Circuit Breakers: Single- and two-pole configurations with 5 mA trip sensitivity.
 7. Molded-Case Switch: Molded-case circuit breaker without trip units.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
 6. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosures before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
 - 2. Test continuity of each line- and load-side circuit.
- B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.
- C. Infrared Scanning: (coordinate with Lowes if required per project) After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches and circuit breakers checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16410

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SECTION 16420 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes ac general-purpose controllers rated 600 V and less that are supplied as enclosed units.
- B. Related Sections include the following:
 - 1. Division 16 Section "Fuses" for fuses in fusible switches.

1.3 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Field Test Reports: Written reports specified in Part 3.
- C. Manufacturer's field service report.
- D. Maintenance Data: For enclosed controllers and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
 - 1. Routine maintenance requirements for enclosed controllers and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- F. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

- B. If stored in areas subjected to weather, cover enclosed controllers to protect from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

1.6 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Specialties and Accessories."
- D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- E. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Spare Fuses: Furnish one spare for every ten installed, but not less than one set of three of each type and rating.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manual and Magnetic Enclosed Controllers:
 - a. Cutler Hammer
 - b. General Electric
 - c. Siemens
 - d. Square D Co.

2.2 MANUAL ENCLOSED CONTROLLERS

- A. Description: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.

2.3 MAGNETIC ENCLOSED CONTROLLERS

- A. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.
- B. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
- C. Combination Controller: Factory-assembled combination controller and disconnect switch.

1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by a nationally recognized testing laboratory.
- D. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 20 tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

2.4 ENCLOSURES

- A. Description: Flush- or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
 1. Outdoor Locations: NEMA 250, Type 3R.
 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.5 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Elapsed Time Meters: Heavy duty with digital readout in hours.
- F. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting. Provide for all motors served over 2 horsepower
- G. Current-Sensing, Phase-Failure Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.6 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

3.3 INSTALLATION

- A. See Division 16 Section "Basic Electrical Materials and Methods" for general installation requirements.
- B. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 16 Section "Basic Electrical Materials and Methods."
- C. Install freestanding equipment on concrete bases complying with Division 3.
- D. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 16 Section "Fuses."

3.4 IDENTIFICATION

- A. Identify enclosed controller components and control wiring according to Division 16 Section "Electrical Identification."

3.5 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers according to Division 16 Section "Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
 - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
 - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 CONNECTIONS

- A. Conduit installation requirements are specified in other Division 16 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed controller bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: Perform the following field quality-control testing:
 - 1. Perform each electrical test and visual and mechanical inspection indicated in NETA ATS, Sections 7.5, 7.6, and 7.16.
 - 2. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including pretesting and adjusting solid-state controllers.
- D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.8 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.9 CLEANING

- A. Clean enclosed controllers internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.10 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that enclosed controllers are installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.
- D. Complete installation and startup checks according to manufacturer's written instructions.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.
 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 16420

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SECTION 16441 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes service and distribution switchboards rated 600 V and less.
- B. The quantity of switchboards, as well as ratings, quantity of devices shall be as shown on the Drawings.
- C. Lowes has secured National Account Pricing through (coordinate with Lowes for correct manufacture per project) Schneider Electric for the Switchboards, Transformers, Overcurrent Protective Devices, Switches and Panel board Centers for this project. Refer to the supplemental instructions for additional information.

1.3 DEFINITIONS

- A. RMS: Root mean square.
- B. SPDT: Single pole, double throw.

1.4 REFERENCES

- A. ANSI/NECA 1 – Good Workmanship in Electrical Contracting.
- B. NFPA 70, (NEC).
- C. NEMA PB-2 - Deadfront Distribution Switchboards.
- D. UL - Underwriters Laboratories, Inc. (NRTL).
- E. UL 891 - Switchboards.
- F. NECA 400 – Installing and Maintaining Switchboards.

1.5 SUBMITTALS

- A. Product Data: For each type of switchboard, overcurrent protective device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes. (Will be provided to the Contractor by the Owner.)
- B. Shop Drawings: For each switchboard and related equipment. (Will be provided to the Contractor by the Owner.)
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of switchboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

- C. Manufacturer's field service report.
- 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. Maintenance Data: For switchboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
 - 1. Routine maintenance requirements for switchboards and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 3. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Designed, manufactured and tested in accordance with the latest applicable standards of ANSI, ASA, IEEE, NEMA, NFPA, and UL.
- B. Certifications:
 - 1. Where equipment is utilized for service entrance, the equipment shall bear the UL "Suitable for Service Entrance" label.
- C. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- D. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- F. 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.
- G. Comply with NEMA PB 2.
- H. Comply with NFPA 70.
- I. Comply with UL 891.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in sections of lengths that can be moved past obstructions in delivery path.
- B. Protect switchboard upon delivery. Either:
 - 1. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.
 - 2. If stored in areas subjected to weather, cover switchboards to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove

loose packing and flammable materials from inside switchboards; install electric heating (250-W per section) to prevent condensation.

- C. Handle switchboards according to NECA 400 and NEMA PB 2.1.

1.8 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace items such as access fencing, doors, lift-out panels, and structures as required to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
 - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 104 deg F
 - b. Altitude: Not exceeding 6600 feet.
- C. Service Conditions: NEMA PB 2, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.
 - 3. Comply with NFPA 70E.

1.9 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.10 EXTRA MATERIALS

- A. Spares: For the following:
 - 1. Potential transformer fuses.
 - 2. Control-power fuses.
 - 3. Fuses for fused switches.
 - 4. Fuses for high pressure contact switches.

PART 2 - PRODUCT

2.1 NOT USED

PART 3 - EXECUTION

3.1 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.2 INSTALLERS

- A. Where metering is provided in switchboard, a technician trained by meter manufacturer shall be retained to configure, adjust and test the meter.
- B. Where metering is to be monitored by Building Automation System (BAS) or other systems, a manufacturer's certified technician shall be retained to program meter for interface to BAS. This technician shall coordinate interface with Contractor responsible for BAS.

3.3 EXAMINATION

- A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1.
- B. Comply with NECA 1.
- C. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 03.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- F. Install filler plates in unused spaces of panel-mounted sections.
- G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- H. For a mixture of various depth sections in the same line-up, orient and align all sections as indicated.
- I. Current Transformers
 - 1. The switchboards will be provided with current transformers that serve the Owner's Building Management System (BMS). The contractor shall route the incoming conductors from the utility pad mount transformer so that only A phase conductors route through the A phase CT, similar for B phase and C phase. Neutral conductors route directly to the neutral bar.

3.5 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

- B. Switchboard Nameplates: Label each switchboard compartment with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 16 Section "Electrical Identification."

3.6 CONNECTIONS

- A. Install equipment grounding connections for switchboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Minimum acceptable value for insulation resistance is 1 mega-ohm.
 - 2. Test continuity of each circuit.
- B. Testing: After installing switchboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. 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.
- C. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies switchboards checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.8 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges. Instantaneous magnetic trip setting on breakers 250A and larger that serve an individual motor shall be set in accordance with NEC 430-52.
- B. Set field-adjustable switches and circuit-breakers per the Electrical Coordination Study as indicated in Section 16075 Electrical Identification.

3.9 CLEANING

- A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 16441

SECTION 16442 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panelboards.
 - 2. Lighting and appliance branch-circuit panelboards with remote operable circuit breakers.
 - 3. Distribution panelboards.
- B. Panelboard shall be of the type (lighting and appliance or distribution) as shown on the Drawings.
- C. The sizes, ratings, number of circuit breakers shall be as shown on the Drawings.
- D. The locations and quantity of panelboards shall be as shown on the Drawings.
- E. Lowes has secured National Account Pricing through (coordinate with Lowes for correct manufacture per project) Schneider Electric for the Switchboards, Transformers, Overcurrent Protective Devices, Switches and Panel board Centers for this project. Refer to the supplemental instructions for additional information.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

1.4 REFERENCES

- A. Review the drawings and all sections of the specifications for equipment furnished by other contractors and the owner throughout the entire project.
- B. ANSI/NECA 1 – Good Workmanship in Electrical Contracting.
- C. NECA 407 – Installing and Maintaining Panelboards

1.5 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes. (Will be provided to the Contractor by the Owner.)
- B. Shop Drawings: For each panelboard and related equipment. (Will be provided to the Contractor by the Owner.)
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.

- c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Field Test Reports: Submit written test reports and 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.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- E. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.6 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. Panelboard shall bear the U.L. Label.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials in accordance with division 1.
- B. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- C. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1.

1.8 PROJECT CONDITIONS

- A. Environmental limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight,
 - 2. Rate equipment for continuous operation per NEMA PB 1, usual service conditions, as follows unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.

1.9 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance

requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.10 EXTRA MATERIALS

- A. Keys: Six spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 NOT USED.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to neca 407 and nema pb 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Do not install panelboards directly to concrete walls, masonry walls or exterior walls. Provide structural channels such as Unistrut to install cabinets at least 3/4 inch away from concrete or masonry walls.
- B. Where panelboards are to be installed in open area without wall for support, provide structural steel channel (Unistrut or equal) to support panelboard tubs.

3.3 INSTALLATION

- A. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.
- B. Install panelboards 72 inches from the finished floor line to the top of panelboard enclosure.
- C. Equipment Mounting: Install freestanding panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 03.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to panelboards.
 - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.

- G. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- H. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- I. Install filler plates in unused spaces.
- J. Provision for Future Circuits at Flush Panelboards: For each flush panelboard, provide two 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- K. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- C. Panelboard Circuit Identification:
 - 1. Provide an indelible circuit number tag or label affixed to the panelboard front immediately adjacent to each circuit breaker or to the dead-front breaker housing frame for each individual branch circuit device or space. Circuit numbers affixed to the panelboard front shall be aligned and centered horizontally with each circuit breaker.
 - 2. Identify multi-pole circuits by a single number where the circuit is indicated as such on the Drawings.
- D. Panelboard Directories:
 - 1. New Panelboards: For panelboards with circuit directory card holders within front doors, provide typewritten circuit directories as follows:
 - a. Provide a changeable directory card for each panelboard.
 - b. The directory cards shall be accurately and neatly typed with circuit number, load identification and room number.
 - c. If the Owner will be using room numbers other than those used on the project documents, prepare the directory utilizing the Owner's designated room numbers
 - d. The cards shall be card stock material of a minimum 65 pound basis weight. The directory cards and directory frames shall be approximately 5 inches wide and fit the directory card frame of the panelboard.
 - e. Provide transparent sheet plastic cover over directory card.
 - f. At each panelboard place the directory card in a directory frame on the rear side of the door of each panelboard.

3.5 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded- case circuit breakers. 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.
- C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services on-line data-processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges. Instantaneous magnetic trip setting on breakers 250A and larger that serve an individual motor shall be set in accordance with NEC 430-52.

3.8 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.
- B. Contractor to make sure all covers for each section are in place and secured after cleaning.

END OF SECTION 16442

SECTION 16461 - DRY-TYPE TRANSFORMERS (1000 V AND LESS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.
- B. Lowes has secured National Account Pricing through (coordinate with Lowes for correct manufacture per project) Schneider Electric for the Switchboards, Transformers, Overcurrent Protective Devices, Switches and Panel board Centers for this project. Refer to the supplemental instructions for additional information.

1.3 SUBMITTALS

- A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated. (Will be provided to the Contractor by the Owner.)
- B. Shop Drawings: Wiring and connection diagrams. (Will be provided to the Contractor by the Owner.)
- C. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C 57.12.91.
- C. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of wall-mounting and structure-hanging supports.

PART 2 - PRODUCTS

2.1 NOT USED.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls and floors for suitable mounting conditions where transformers will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Transformers shall be set on vibration isolation mounts. Bolt neoprene mounts to floor and bolt transformer skids to mounts.
- B. Provide all transformers with external vibration pads or spring isolators between the transformer enclosure and the mounting surface.
- C. Install floor-mounted transformers on 4-inch high concrete pads and at least 12 inches away from wall and other obstructions.
- D. Where transformers indicated to be supported from ceiling structure, provide necessary supports, and vibration isolation.
- E. Provide terminals of the proper size and type for line, load and ground.
- F. Each transformer shall physically fit in the available floor space allocated and be capable of moving transformer into or out of place while clearing all interior and exterior doors leading to the transformer location. Allow proper electrical and working space clearances in accordance with all applicable electrical codes for all transformers.
- G. Maintain clearance of all ventilation openings.
- H. Clean all ventilation openings.
- I. Install vibration mountings in a neat and workmanlike manner.

3.3 CONNECTIONS

- A. Utilize flexible conduit connections for all connections to the transformer enclosure.
- B. Where feeders come from the floor below, they shall terminate at the end of transformer enclosure with metal grounding bushings with neoprene throat inserts. Ground bushings to the transformer enclosures.
- C. Where feeders come from overhead, the conduits shall enter the side of the transformer enclosure. The conduits within 36 inches of the enclosure shall be flexible steel. A pull box may be installed on the connection. The pull box shall be sized per NEC for the application. The feeder conduits within 36 inches of pull box shall be flexible steel. Conductors shall route from the pull box to transformer enclosure through nipples with insulated bushings on each side.
- D. Where transformers are installed next to switchboards, secondary conductors may be routed from transformer to secondary switchboard through a 12-inch long wiring gutter, flanged and bolted to transformer enclosure and switchboard enclosure. Under such conditions:

1. Provide a neoprene gasket between gutter and transformer enclosure and bond gutter to transformer enclosure with a flexible copper grounding strap.
 2. The opening in the transformer enclosure for the secondary connections to the switchboard shall be oversized to allow for setting of the transformer on the neoprene mounts.
 3. The flanges on the gutter shall likewise be oversized so that the opening in the transformer enclosure will be completely covered and sufficient metal remains for bolting gutter flange.
- E. All terminals, including those for changing taps, shall be readily accessible by removing the front cover of the transformer.
- F. Ground equipment according to Division 16 Section "Grounding and Bonding".
- G. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.
- B. Adjust buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 16461

SECTION 16491 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes cartridge fuses, rated 600 V and less, for use in switches, panelboards, switchboards, controller and spare fuse cabinets.

1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Let-through current curves for fuses with current-limiting characteristics.
 - 3. Time-current curves, coordination charts and tables, and related data.
- B. Ambient Temperature Adjustment Information. If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses adjusted.
 - 1. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Provide fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.
- E. UL Standard 248 – Low Voltage Fuses.

1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged in original cartons or containers and identified with labels describing contents.
 - 1. Fuses: Quantity equal to 10 percent of each fuse type and size, but not fewer than 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.; Bussmann Div.
 - 2. Littelfuse, Inc.
 - 3. Ferraz Shawmut; Mersen Fuses

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse;
 - 1. Class and current rating indicated
 - 2. Utilize only 600V rated fuses in distribution systems with both 480/277V and 208/120V systems.

2.3 SPARE FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch-thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch-high letters on exterior of door.
 - 4. Fuse Pullers: For each size fuse.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Main Service: Class L, time delay. (Bussmann KRP-C or equal)
- B. Main Feeders: Class L, time delay. (Bussmann KRP-C or equal)
- C. Motor Branch Circuits: Class RK1, time delay. (Bussmann LPS-RK or equal by Littelfuse)
 - 1. Motor fuses shall be sized at not greater than 125% of motor nameplate rating.
- D. Other Branch Circuits: Class RK1, time delay. (Bussmann LPS-RK)

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare fuse cabinet.

3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 16491

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SECTION 16511 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered under this section consists of the furnishing of all necessary labor, materials, equipment and services to completely execute the interior lighting systems as described in this specification and as shown on the drawings
 - 2. Interior lighting fixtures, supports and accessories.
 - 3. Lighting fixtures mounted on exterior building surfaces for egress lighting
 - 4. Exit signs and Exit signs with emergency lighting.
 - 5. Accessories, including occupancy sensors.
- B. Related Sections include the following:
 - 1. Division 16 Section "Wiring Devices" for manual wall-box dimmers.
 - 2. Division 16 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 3. Lowe's has National Account Contacts for the Lighting Fixture Package. Refer to the supplemental instructions for additional information.
 - a. Current Lighting
 - b. Acuity Brands Lighting

1.3 REFERENCES

- A. Review the Drawings and all sections of the Specifications for equipment furnished by other Contractors and the Owner throughout the entire project.
- B. ANSI/NECA 1 – Good Workmanship in Electrical Contracting.
- C. IEEE C62.41, guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits.
- D. FCC 47 CFR Part 15, Federal Code of Regulation (CFR) testing standard for electronic equipment.
- E. IESNA LM-79, Electrical and Photometric Measurements of Solid-state Lighting Products.
- F. IESNA LM-80, Approved Method for Measuring Lumen Maintenance of LED Lighting Products.
- G. NEMA SSL 3, High-Power White LED Binning for General Illumination.
- H. UL1598, Standard for Safety of Luminaires.
- I. Illuminating Engineering Society Lighting Handbook and Recommended Practices.

1.4 DEFINITIONS

- A. CRI: Color rendering index.
- B. CU: Coefficient of utilization.

- C. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:
 - 1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.
- D. RCR: Room cavity ratio.
- E. SPD: Surge protective device

1.5 SUBMITTALS

- A. Product Data: For each luminaire 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. Performance Data for Luminaire.
 - 6. Photometric data based on laboratory tests of each luminaire type, complete with indicated lighting engine and accessories.
 - a. 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.
 - 7. Motion Sensors.
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. Wiring Diagrams: Power, signal, and control wiring.
- D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. Catalog data for each fixture. Include the lighting engine installed in that fixture.
- E. Warranties: Special warranties specified in this Section.

1.6 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 IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.
- D. Furnish products listed and classified by UL as suitable for purposes specified and shown.
- E. Perform work in accordance with NECA Standard of Installation.
- F. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- G. Luminaire shall be of uniform quality and appearance.
- H. Manufacturers of LED luminaire shall demonstrate a suitable testing program incorporating high heat, high humidity and thermal shock test regimens to ensure system reliability and to substantiate lifetime claims.

- I. The use of IESNA LM-80 data to predict luminaire lifetime is not acceptable.
 - J. At time of manufacture, electrical and light technical properties shall be recorded for each luminaire. At a minimum, this should include lumen output, CCT, and CRI. Each luminaire shall utilize a unique serial numbering scheme. Technical properties must be made available for a minimum of 5 years after the date of manufacture.
 - K. Luminaires shall be provided with a 5 year warranty covering, LEDs, drivers, paint and mechanical components.
 - L. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.
- 1.7 COORDINATION
- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store and handle materials in accordance with Division 01.
 - B. Deliver luminaires and components carefully to avoid breakage, bending and scoring finishes. Do not install damaged equipment.
 - C. Store luminaires and accessories in original cartons and in clean dry space; protect from weather and construction traffic.
- 1.9 WARRANTY
- A. Provide warranty in Accordance with requirements of Division 01.
 - B. 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, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires, including LEDs, drivers and mechanical components: 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.
 - C. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- 1.10 EXTRAMATERIALS (COORDINATE WITH LOWES IF REQUIRED PER PROJECT)
- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. LED Lighting Warehouse Fixtures: 1 for every 200 of each type and rating installed. Furnish at least one of each type.
 - 2. LED Lighting Fixtures (Other than Warehouse): 1 for every 100 of each type and rating installed. Furnish at least one of each type.

3. Battery and Charger: One for each type of emergency lighting unit installed.
4. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

1.11 ACCESSORIES

- A. Plaster Frames
 1. Plaster frames shall be furnished for each recessed luminaire installed in dry wall type ceilings, regardless of Lighting Fixture Schedule part numbers.
- B. Seismic clips
 1. Provide seismic clips for all lay-in fixtures in grid ceiling.
- C. Gasketing
 1. Provide necessary gasketing and/or frames to eliminate undesirable light "leakage" around fixture door/housing.
- D. Lensing
 1. Where acrylic lens is specified, this shall be defined as 100% virgin methyl methacrylate
- E. Whips
 1. All fixtures, except for warehouse fixtures, shall be connected from the outlet box to the fixture with either flexible conduit or flexible modular wiring system. Flexible conduit shall be not less than ½", and contain phase, neutral and ground conductor of not less than #12, and be not greater than 6'-0" in length.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 FIXTURES AND COMPONENTS, GENERAL

- A. LED Luminaires:
 1. Provide LED luminaires, of types and sizes indicated on fixture schedule.
 2. Material and specifications for each luminaire are as follows:
 - a. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver¹ (power supply).
 - b. Each luminaire shall be rated for a minimum operational life of 50,000 hours. This life rating must be conducted 40C ambient temperature.
 - c. Each luminaire is capable of operating above 100°F (37°C), but not expected to comply with photometric requirements at elevated temperatures.
 - d. Photometry must be compliant with IESNA LM-79 and shall be conducted at 25°C ambient temperature.

- e. The individual LEDs shall be constructed such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
 - f. Luminaire shall be constructed such that LED modules may be replaced or repaired without replacement of the whole luminaire.
 - g. Each luminaire shall be listed with Underwriters Laboratory, Inc. under UL1598 for luminaires, or an equivalent standard from a nationally recognized testing laboratory.
3. Technical Requirements:
- a. Electrical:
 - 1) Power Consumption: Maximum power consumption allowed for the luminaire shall be determined by application. The luminaire shall not consume power in the off state.
 - 2) Operation Voltage: The luminaire shall operate from a 60 HZ ± 3 HZ AC line over a voltage ranging from 108 VAC to 490 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
 - 3) Power Factor: The luminaire shall have a power factor of 0.90 or greater.
 - 4) THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent.
 - 5) Surge Suppression: The luminaire on-board circuitry shall include fused surge protection devices (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The SPD shall protect the luminaire from damage and failure for common mode transient peak voltages up to 10 kV (minimum) and transient peak currents up to 5 kA (minimum). SPD shall conform to UL 1449 depending on the components used in the design. SPD performance shall be tested per the procedures in ANSI/IEEE C62.41-1992 (or current edition) for category C (standard). The SPD shall fail in such a way as the Luminaire will no longer operate. The SPD shall be field replaceable.
 - 6) Each Luminaire shall have integral UL Listed Class II power supplies. Class I power supplies will not be acceptable.
 - 7) Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.
 - 8) RF Interference: LED Drivers must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section IS regulations concerning the emission of electronic noise.
 - 9) Drivers shall have a Class A sound rating.
 - b. Photometric Requirements:
 - 1) Illuminance: The illuminance shall not decrease by more than 30% over the expected operating life. The measurements shall be calibrated to standard photopic calibrations.
 - c. Thermal Management:

- 1) The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
 - 2) The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.
 - 3) Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.
 - 4) The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature.
 - 5) The heat sink material shall be aluminum.
- d. Physical and Mechanical Requirements:
- 1) The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply for the luminaire shall be integral to the unit.
 - 2) The maximum weight of the luminaire shall be 50 lbs.
 - 3) The assembly and manufacturing process for the LED luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
 - 4) Luminaires shall be capable of withstanding cyclical loading in (G
 - 5) = Acceleration of Gravity): a minimum peak acceleration level of
 - 6) 3.0 G peak-to-peak sinusoidal loading with the internal driver installed, for a minimum of 100,000 cycles without failure of any luminaire parts. Testing to be performed in three planes: a horizontal plane parallel to the direction of mounting, a horizontal plane perpendicular to the direction of mounting and the vertical plane.
 - 7) The optical assembly of the luminaire shall be protected against dust and moisture intrusion per the requirements of IP-66 (minimum) to protect all optical components.
 - 8) The electronics/power supply enclosure shall meet the requirements for NEMA UL wet location.
 - 9) Door shall be hinged and secured to the housing in a manner to prevent its accidental opening.
 - 10) The circuit board and power supply shall be contained inside the luminaire. Electrolytic capacitors used in the power supplies shall be rated for -40°F to 220°F (40°C to +105°C), long life (> 5000 hours), and operated at no more than 70% of their rated voltage, and 70% of rated current.
- e. Materials:
- 1) Housings shall be fabricated from materials that are designed to withstand a 3000-hour salt spray test as specified in ASTM Designation: B 117.
 - 2) Each refractor or lens shall be made from UV inhibited high impact plastic such as acrylic and be resistant to scratching.

- 3) Polymeric materials (if used) of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VO flame retardant materials. The len(s) of the luminaire are excluded from this requirement.
4. Provide LED luminaires complete with gaskets forming weatherproof assembly.
- B. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- C. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- F. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- H. Exposed Hardware Material: Stainless steel.
- I. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
- N. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- O. Metal Parts: Free of burrs and sharp corners and edges.
- P. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- Q. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to

prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

R. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch unless different thickness is scheduled.
 - b. UV stabilized.
2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 LIGHTING FIXTURES

A. Fixtures as shown on the Contract Drawings.

2.4 EXIT SIGNS WITH EMERGENCY LIGHTING UNITS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Sign illumination shall be provided by LED AC lamp source.
- C. Provide 277/120 volt transformer where applicable.
- D. Where exit signs with battery back-up are indicated, provide self-contained, fully automatic operation emergency power supply, with minimum 90 minute emergency illumination capacity, consisting of automatic solid state charger, test switch, and maintenance-free nickel cadmium battery with minimum ten (10) year prorated battery warranty.
- E. Internally Lighted Signs:
 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - g. Integral Self-Diagnostics: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
 3. Master/Remote Sign Configurations:

- a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
- b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.5 EMERGENCY LIGHTING TRANSFER DEVICES

A. Generator Transfer Device for Individual Fixtures:

- 1. Device to automatically transfer individual lighting fixture load from normal power source to auxiliary power source (generator or central inverter system). Device shall operate by sensing the loss of normal power and then transferring fixture load to auxiliary power source.
- 2. Unit shall be UL 924 (Emergency Lighting Equipment) listed device and comply with the current National Electrical Code.
- 3. Unit shall operate at 120 or 277 VAC, 60 Hz, and shall have all inputs fused at 3 amps maximum.
- 4. Generator transfer devices shall be factory installed in fixture component compartments by fixture manufacturers.
- 5. Device shall be Philips Bodine Model GTD or approved equal.

B. Generator Transfer Device for Individual Fixtures:

- 1. Device to automatically transfer individual lighting fixture load from normal power source to auxiliary power source (generator or central inverter system). Device shall operate by sensing the loss of normal power and then transferring fixture load to auxiliary power source.
- 2. Unit shall be UL 924 (Emergency Lighting Equipment) listed device and comply with the current National Electrical Code.
- 3. Unit shall operate at 120 or 277 VAC, 60 Hz, and shall have all inputs fused at 3 amps maximum.
- 4. Generator transfer devices shall be factory installed in fixture ballast compartments by fixture manufacturers.
- 5. Device shall be Philips Bodine Model GTD or approved equal.

C. Emergency Lighting Relay Control and Switch Bypass Device:

- 1. Device to automatically transfer individual lighting fixture load from normal power source to auxiliary power source (generator or central inverter system). Device shall operate by sensing the loss of normal power and then transferring fixture load to auxiliary power source:
 - a. Automatically transfer individual lighting fixture load from normal power source to emergency power source (generator or central inverter system).
 - b. Automatically bypass local switching means of lighting circuit (emergency circuit).
- 2. Device shall operate by sensing the loss of normal power and then transferring entire lighting circuit (hot and neutral) to emergency power source.
- 3. Unit shall be UL 924 (Emergency Lighting Equipment) listed device and comply with the current National Electrical Code.

4. Unit shall operate at 120 or 277 VAC, 60 Hz, and be rated for 120 through 277 VAC, 50/60 Hz, at up to 20 amperes of lighting load.
 5. Device shall be wall mounted type unit.
 6. Provided device in quantity and locations as indicated in the Contract Documents.
 7. Device shall be Philips Bodine Model GTD20A or approved equal
- D. Provide other emergency lighting and associated controls as indicated in the Contract Documents.

2.6 SUPPORTS FOR RECESSED LAY-IN LIGHTING FIXTURES

- A. For recessed lay-in (grid) fixtures, provide safety cables or safety chains attached at each corner of fixtures supported from the structural members above to support all recessed lay-in fixtures.
- B. Safety cables shall be as follows:
 1. For steel structure, cables shall be Gripple Loop Hanger #2, Erico/Caddy #SLD2L(X), B-Line "KwikWire" equivalent, or approved equal:
- C. Safety chains shall be unwelded steel sash/safety chain, steel jack chain, or steel double loop chain. Working load limit of each individual chain shall be a minimum of five times (5X) the load weight of the fixtures being supported.
- D. Provide plaster frames or rings for all fixtures recessed in plaster ceilings
- E. Supply recessed fixtures complete with proper trim type required for ceiling system in which they are installed.

2.7 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 16 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.
- E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.8 FINISHES

- A. Fixtures: Manufacturers' standard, unless otherwise indicated.
 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 2. Metallic Finish: Corrosion resistant.

2.9 LIGHTING CONTROL DEVICES

- A. Dimming Controls: Sliding-handle type with on/off control; compatible with device and having light output and energy input over the full dimming range.
- B. Occupancy Sensors: Adjustable sensitivity and off delay time range of 1 to 15 minutes.
 1. Device Color:

- a. Wall Mounted: Ivory.
- b. Ceiling Mounted: White.
- 2. Occupancy detection indicator.
- 3. Combination Sensors: Ultrasonic and infrared sensors combined.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Supports installed for fixtures shall be provided to carry 400% of the applied weight.
- C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
 - 1. Install a minimum of two ceiling support chains for each fixture. Locate not more than 6 inches from fixture corners. Sheet metal screw chain to fixture, wrap chain around joists with S-hook.
 - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- D. All Other Lighting Fixtures:
 - 1. Suspend or support independently of the ceiling construction all recessed fixtures which are not the lay-in (grid) type and all surface type fixtures, in or on the ceiling, from the structural members above.
 - 2. Where steel channel supports systems are utilized to support the ceiling construction, support the fixtures from the top members of the system rather than from the structural members above them.
 - 3. Mount pendant mounted fixtures on structural channel supported from structural members above them.
 - 4. Mount exit signs and emergency lighting units on standard 4 inch outlet boxes.
 - 5. Support lighting track every 2 feet from structure above.
- E. Suspended Fixture Support: As follows:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Suspend from cable.
- F. Adjust aimable fixtures to provide required light intensities.

3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 CLEANING

- A. Clean all fixtures at end of work.

3.4 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION 16511

SECTION 16543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 16 Section "General Electrical Requirements" apply to this section.
- C. Division 16 Section "Basic Electrical Materials and Methods" for supports and anchors.
- D. Division 16 Section "Conductors and Cables".
- E. Division 16 Section "Grounding and Bonding".
- F. Division 16 Section "Electrical Identification".

1.2 SUMMARY

- A. This Section includes:
 - 1. Raceways, fittings, boxes, handholes, and manholes for direct buried and concrete-encased electrical distribution.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Division 01 and Division 16 Section "General Electrical Requirements":
 - 1. Product data for the following products:
 - a. Raceways, Raceway fittings, separators, duct-bank materials, manholes, handholes, boxes, solvent cement, warning tape and warning planks.
 - 2. Shop drawings for:
 - a. Detailing fabrication and installation for custom manholes or handholes including duct entry provisions, reinforcing details, frame and cover design, manhole frame support rings, ladder details, grounding details, sump details, joint details, and cable racks, pulling irons, lifting irons.
- B. Record Drawings: Submit Record Drawings as required by Division 01 and Division 16 Section "General Electrical Requirements":
 - 1. Accurately record actual routing of all exterior buried raceway including coordination with other surrounding utilities and underground structures. Provide scaled plans and sections that indicate dimensions from finished grade or other fixed structural elements.

1.4 DEFINITIONS

- A. Terminology used in this specification is as defined below:
 - 1. GRS: Galvanized Rigid Steel Conduit
 - 2. RMC: Rigid Metal Conduit
 - 3. RNC: Rigid Nonmetallic Conduit

1.5 QUALITY ASSURANCE

- A. Materials shall be manufactured by companies that have been specializing in the products specified in this Section, for a minimum of 3 years.
- B. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7, and that is acceptable to AHJ.
 2. Marked for intended use.
 - C. Comply with NFPA 70 and ANSI C2.
 - D. Test and inspect pre-cast concrete utility structures according to ASTM C 1037.
 - E. Non-concrete Handhold 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 an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the 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.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver ducts to project site with ends capped and store nonmetallic ducts with supports to prevent bending, warping, and deformation.
 - B. Store pre-cast and other factory –fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings, if present, are visible.
 - C. Lift and support pre-cast concrete units only at designated lifting or supporting points.
- 1.7 PROJECT CONDITIONS
- A. Once the electrical service has been engaged, interruption of this service shall not occur unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated.
 1. Notify Architect no fewer than seven days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without Architects written permission.
- 1.8 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 manhole, 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 Architect.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

- B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

2.2 RACEWAYS AND FITTINGS

A. Metal Conduit and Tubing

1. Available Manufacturers:
 - a. AFC Cable Systems, Inc.
 - b. Alfex Corporation, a Southwire Company
 - c. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - d. Electri-Flex Co.
 - e. Indalex
 - f. Manhattan/CDT/Cole-Flex
 - g. O-Z/Gedney; Unit of General Signal (Fittings)
 - h. Republic Raceway
 - i. Tyco International; Allied Tube & Conduit Div.
 - j. Wheatland Tube Co.
2. RMC:
 - a. GRS: Hot-dip galvanized: ANSI C80.1, UL 6
3. Plastic-Coated GRS and Fittings: NEMA RN 1, UL-listed. Coating thickness of 0.40 inches (1 mm), minimum.
4. Fittings: NEMA FB 1; compatible with raceway and tubing materials.

B. Nonmetallic Raceway and Tubing

1. Available Manufacturers:
 - a. AFC Cable Systems, Inc. (Tubing)
 - b. American International.
 - c. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - d. Arnco Corp.
 - e. Cantex Inc.
 - f. Certaineed Corp.; Pipe & Plastics Group.
 - g. Condux International.
 - h. ElecSYS, Inc.
 - i. Electri-Flex Co.
 - j. Lamson & Sessions; Carlon Electrical Products.
 - k. Manhattan/CDT/Cole-Flex.
 - l. RACO; Division of Hubbell, Inc.
 - m. Spiraldut, Inc./AFC Cable Systems, Inc.
 - n. Superflex Ltd.
 - o. Thomas & Betts Corporation.
2. RNC: Schedule 40 (type EPC-40-PVC) and 80 (type EPC-80-PVC) PVC: NEMA TC 2, UL 651

- a. Fittings: match to raceway type and material: NEMA TC 3, NEMA TC 6, UL 651, as applicable.

C. DUCT ACCESSORIES

- 1. Duct Separators shall be factory-fabricated rigid interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
- 2. Underground-line warning tape specified in Division 16 Section "Identification for Electrical Systems."
- 3. Concrete warning planks shall be nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
 - a. Color: Red dye added to concrete during batching.
 - b. Labeling: Mark each plank with "ELECTRICAL" in 2-inch high, 3/8-inch deep letters.

2.3 PRE-CAST CONCRETE HANDHOLES AND BOXES

A. General

- 1. Available Manufacturers:
 - a. Carder Concrete Products.
 - b. Christy Concrete Products
 - c. Elmhurst-Chicago Stone Co.
 - d. Oldcastle Pre-cast Group
 - e. Riverton Concrete Products; a division of Cretex Companies, Inc.
 - f. Utility Concrete Products, LLC
 - g. Utility Vault Co.
 - h. Wausau Title, Inc.

B. Comply with ASTM C858 for design and manufacturing process.

C. Pre-cast concrete handholes and boxes shall be factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of the 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. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
- 3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
- 4. Frame and Cover: Weatherproof aluminum frame, with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.

5. The cover finish shall be a nonskid finish with a minimum coefficient of friction of 0.50.
6. The cover shall have the following legend lettering molded into the cover:
 - a. "COMMUNICATIONS"
 - b. "ELECTRICAL"
 - c. "FIBER OPTICS"
 - d. "LIGHTING"
 - e. Wording appropriate for service. Coordinated with Owner prior to ordering.
7. Units shall be designed for flush burial and have an open bottom, unless otherwise indicated.
8. Extensions and slabs shall be designed to mate with bottom of enclosure and shall be same material as enclosure.
 - a. Extension shall provide an increased depth of 12 inches.
 - b. Slab shall be the same dimensions as bottom of enclosure and arranged to provide closure.
9. Windows shall be included as pre-cast 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 openings shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie into 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.
10. Duct entrances into handhole walls shall have cast end-bell or duct-terminating fittings in the 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.
11. 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.

2.4 HANDHOLES AND BOXES OTHER THAN PRE-CAST CONCRETE

A. General

1. Description: Comply with SCTE 77.
2. Color of Frame and Cover: Gray where installed in concrete or other paved area; Green where installed in grass area.
3. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
4. Load Ratings:

- a. Boxes and covers installed in sidewalks and other areas not subject to normal vehicular traffic shall be rated for a design load of 8,000 lbs. minimum.
 - b. Boxes and covers installed in driveways, parking lots, and other off-roadway applications shall be rated for a design load of 15,000 lbs. minimum.
 - c. Boxes and covers installed in roadways and other high vehicular traffic areas shall be rated for a design load of 28,800 lbs.
- 5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- 6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- 7. Cover Legend: Molded lettering, applicable logo from the following:
 - a. "COMMUNICATIONS"
 - b. "ELECTRIC"
 - c. "FIBER OPTICS"
 - d. "LIGHTING"
 - e. Wording appropriate for service. Coordinated with Owner prior to ordering.
- 8. Duct Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- 9. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- 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.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.
 - d. NewBasis.
 - e. Strongwell
- C. Fiberglass Handholes and Boxes with Polymer-Concrete frame and cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of reinforced concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carson Industries LLC.
 - b. Christy Concrete Products.
 - c. Nordic Fiberglass, Inc.
- E. High-Density Plastic Boxes: Injection molded of high-density polyethylene of copolymer-polypropylene. Cover shall be polymer concrete.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carson Industries LLC.
 - b. Nordic Fiberglass, Inc.
 - c. PenCell Plastics.

2.5 PRE-CAST MANHOLES

- A. Pre-cast-concrete manholes shall be furnished in sizes as indicated on the plans and as specified herein. Pre-cast manholes shall be constructed of reinforced concrete, complete with all appurtenances and accessories required.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carder Concrete Products.
 - b. Christy Concrete Products.
 - c. Elmhurst-Chicago Stone Co.
 - d. Oldcastle Pre-cast Group.
 - e. Riverton Concrete Products; a division of Cretex Companies, Inc.
 - f. Utility concrete Products, LLC.
 - g. Utility Vault Co.
 - h. Wausau Tile, Inc.
- B. Comply with ASTM C858, with structural design loading as specified in Part 3 "Underground enclosure Application" and with interlocking mating sections, complete with accessories, hardware, and features.
 1. Windows: Pre-cast 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 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 into 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.
 - C. Concrete Knockout Panels: 1-1/2 to 32 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.
- 2.6 CAST-IN-PLACE MANHOLES
- A. Description: underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for concrete entrance and sleeve for ground rod.
 - B. Materials: Comply with ASTM C858 and with Division 03 Section "Cast-In-Place Concrete."
- 2.7 UTILITY STRUCTURE ACCESSORIES
- A. Utility structures shall be installed complete including accessories as listed below.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Bilco Company (The).
 - b. Campbell Foundry Company.
 - c. Carder Concrete Products
 - d. Christy Concrete Products.
 - e. East Jordan Iron Works, Inc.
 - f. Elmhurst-Chicago Stone Co.
 - g. McKinley Iron Works, Inc.
 - h. Neenah Foundry Company.
 - i. NewBasis
 - j. Oldcastle Precast Group
 - k. Osburn Associates, Inc.
 - l. Pennsylvania Insert Corporation.
 - m. Riverton concrete Products; a division of Cretex Companies, Inc.
 - n. Strongwell Corporation; Lenoir City Division.
 - o. Underground Devices, Inc.
 - p. Utility Vault Co.
 - q. Wausau Tile, Inc.
 - B. 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; minimum 16 inch diameter or as required for proper service.
 - 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. "COMMUNICATIONS"
 - b. "ELECTRIC"
 - c. "FIBER OPTICS"
 - d. "LIGHTING"
 - e. Wording appropriate for service. Coordinated with Owner prior to ordering.
 - 3. Manhole Chimney Components: Pre-cast concrete rings with dimensions matching 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 C387, Type M, may be used.
- C. Manhole Sump Frame and Grate: ASTM A48/A 48M, Class 30B, gray cast iron.
- D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2 inch diameter eye, and 1 by 4 inch bolt.
 - 1. Working load embedded in 6 inch, 4000-psi concrete is 13,000-lbf maximum tension
- E. Pulling Eyes in Non-concrete Walls: Eyebolt with reinforced fastening, 1-1/4 inch diameter eye, rated 2500-lbf minimum tension.
- F. Pulling-In and Lifting Irons in Concrete Floors: 7/8 inch diameter, hot-dip galvanized, bent 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.
- G. Bolting Inserts for concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of non-corrosive, chemical-resistant, non-conductive 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.
- H. Expansion Anchors for Installation after Concrete is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
- I. 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.
- J. 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 shall have slots along length for cable ties.
- K. Duct-Sealing Compound: Non-hardening, 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.
- L. Fixed Manhole Ladders: Arranged for attachment to wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.
- M. Cover Hooks: Heavy duty, design for lifts 60-lbf and greater. Two required.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables over 600 volts: RNC, NEMA Type EPC-80 PVC, in concrete-encased duct bank, unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 volts and Less: RNC, NEMA Type EPC-80 PVC, in concrete-encased duct bank, unless otherwise indicated.
- C. Ducts for Electrical Feeders 600 volts and Less: RNC, NEMA Type EPC-80 PVC, in direct-buried duct bank, unless otherwise indicated.
- D. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40 PVC, indirect-buried duct bank, unless otherwise indicated.
- E. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40 PVC, in concrete-encased or direct-buried duct bank, unless otherwise indicated.
- F. Underground Ducts Crossing Paved Paths, Walks, Driveways, and Roadways: RNC, NEMA Type EPC-80 PVC, encased in reinforced concrete to a minimum of 5 feet beyond each side of ground surface type.

3.2 UNDERGROUND ENCLOSURE INSTALLATION

- A. Handholes and Boxes for 600 volts and Less, including Telephone, Communications, and Data Wiring:
 - 1. Units in roadways and Other Deliberate Traffic Paths: Pre-cast 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: Pre-cast Concrete, AASHTO HB 17, H-20 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate loading by Vehicles: Pre-cast Concrete, AASHTO HB 17, H-10 structural load rating.

4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced Polyester resin structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Manholes: Pre-cast 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.

3.3 EARTHWORK

- A. Excavation and Backfilling: Comply with Specification Section "Earth Moving" 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 and compaction is complete.
- 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. Comply with Specification Section "Turf and Grasses and Plants".
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching" to the approval of the Owner.

3.4 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 [48-inches] [12.5 feet] [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 the same plane.
- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 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 with out 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. Install conduit penetrations of building walls as specified in Division 16 Section "Common Work Results for Electrical."
- F. Sealing: Provide temporary closure at termination 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 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 the ducts or duct group.
 - 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end 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 the 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 $\frac{3}{4}$ -inch reinforcing rod dowels 18-inches into concrete on both sides of joint near corners of envelope.
 - 3. 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.
 - 4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 - 5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured with out soil inclusions; otherwise, use forms.
 - 6. 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 signal ducts.
 - 7. 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 of vehicles, unless otherwise indicated.
 - 8. 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.
 - 9. 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 18-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. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6-inches in nominal diameter.
4. Install backfill as specified in Division 31 Section "Earth Moving."
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 run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
6. Install ducts with a minimum of 3-inches between ducts for like services and 6-inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36-inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. 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 base. Install insulated grounding bushings on terminations at equipment.
10. Warning Planks: Bury warning planks approximately 12 inches above all direct-buried ducts and duct banks placing them 24-inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18-inches. Space additional planks 12-inches apart, horizontally.

3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Cast-in-place Manhole Installation:

1. Finish interior surfaces with a smooth-troweled finish.
2. Windows for future duct connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
3. Cast-in-place concrete, formwork, and reinforcement are specified in Division 03 Section "Cast-in-Place Concrete."

B. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C891, 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.
- C. 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. Install handholes with bottom below the frost line, minimum 24" below grade or as noted on plans.
 4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1-inch above grade.
 5. Where indicated, cast handhole cover frame integrally with handhole structure.
- D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
- E. Manhole Access: Circular opening in manhole roof; sized to match cover size.
1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
 2. 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.
- F. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07. 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.
- G. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 07. After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.
- H. Hardware: Install removable hardware, including pulling eye, cable stanchions, and cable arms, and insulators, as required for installation and support of cable and conductors and as indicated.
- I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
- J. 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.
- K. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.
- 3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRE-CAST CONCRETE
- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes and boxes with bottom below the frost line, minimum 24" below grade or as noted on plans.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, non-deliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box frame. Bottom of ring shall rest on compacted earth.
 - 1. Concrete: 3000 psi, 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.
 - 2. Dimensions: 10-inch wide by 12-inches deep.

3.7 GROUNDING

- A. Ground underground ducts and utility structures according to Division 16 Section "Grounding and Bonding".

3.8 INSTALLATION ACCEPTANCE

- A. Prior to final acceptance of the duct bank and associated structures, pull an aluminum or wood test mandrel through the duct to prove joint integrity and to verify ducts have not been deformed. Provide mandrel equal to 80 percent fill of the duct. Test duct bank, manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 16 Section "Grounding and Bonding". Correct any deficiencies and retest as specified above. Clean internal surfaces of manholes (including sumps) and handholes and remove foreign materials.

END OF SECTION 16543

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SECTION 16548 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL REQUIREMENTS

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 RELATED SECTIONS INCLUDE THE FOLLOWING:

- A. Division 20 Section "Seismic Controls for Mechanical, Electrical and Plumbing Systems" for general requirement and related documents that apply to this section.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 SUMMARY

- A. Seismic bracing, restraints, and controls for all electrical systems specified herein shall be designed and installed as required by Division 20 Section "Seismic Controls for Mechanical, Electrical and Plumbing Systems".

1.5 SUBMITTALS

- A. Provide submittals as required by Division 20 Section "Seismic Controls for Mechanical, Electrical and Plumbing Systems" for all electrical systems specified herein.

PART 2 - PRODUCTS AND MATERIALS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION 16548

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SECTION 16750 - VOICE AND DATA COMMUNICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes:
 - 1. Telephone service conduit.
 - 2. Conduit and junction boxes for voice and data communication outlets
 - 3. Telephone backboard.
- B. Voice and data communication cabling, device plates, terminations, and testing shall be by Owner.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. LAN: Local area network.
- C. PVC: Polyvinyl chloride.

1.4 SUBMITTALS

- A. Product Data: Include data on features, ratings, and performance for each component specified.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of conduit and boxes with Owner's telecommunications and LAN equipment suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute to other participants.
 - 3. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Conduit Measuring Tape. Conduit measuring tape shall be polyolefin, labeled in 1 foot increments, and have pull strength of not less than 140 pounds.

1. Ideal #31-347
2. Kena MT3000
3. Equal.

2.2 MOUNTING ELEMENTS

- A. Cable Trays: Comply with Division 16 Section "Cable Trays."
- B. Raceways and Boxes: Comply with Division 16 Section "Raceways and Boxes."
- C. Backboards: 3/4-inch, interior-grade, fire-retardant-treated plywood.

2.3 IDENTIFICATION PRODUCTS

- A. Comply with Division 16 Section "Electrical Identification".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide (2) 4" conduits from the property line to the telephone service equipment board. Conduit shall be type PVC below grade, with type RGS long radius 90 degree sweeps, and type RGS riser through the slab. Refer to plans for locations.
- B. Provide (1) 4" conduit from the telephone service equipment board to the Visitor's Center. Refer to plans for locations.
- C. In Office areas, provide 3/4" conduit from each tel/data outlet to above ceiling
- D. In Warehouse areas, provide 3/4" conduit from each tel/data outlet to the cable tray.
- E. Provide conduit measuring tape in all conduits.

3.2 GROUNDING

- A. Comply with Division 16 Section "Grounding and Bonding."

3.3 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

- A. Install plywood backboards on walls of equipment rooms and wiring closets from floor to ceiling. Plywood shall be 3/4" thick type ACX. Paint plywood with white fire-retardant paint.

3.4 INSTALLATION STANDARDS

- A. Comply with requirements in TIA/EIA-568-A and TIA/EIA-569-A.

3.5 IDENTIFICATION

- A. In addition to requirements in this Article, comply with applicable requirements in Division 16 Section "Electrical Identification" and TIA/EIA-606.

END OF SECTION 16750